Wyoming Department of Environmental Quality
Air Quality Division

PERMIT APPLICATION ANALYSIS

NAME OF FIRM:	Solvay Soda Ash Joint Venture
RESPONSIBLE OFFICIAL:	Richard Casey, Vice President
ADDRESS OF FIRM:	P.O. Box 1167 Green River, Wyoming 82934
TELEPHONE NUMBER:	(307) 875-6500
TYPE OF OPERATION:	Trona Mine & Soda Ash Chemical Production Plant
LOCATION OF PLANT:	NE¼, Section 31, T18N, R109W, Sweetwater County, Wyoming (the plant is located about 15 miles west of the town of Green River, about 2 miles south of I-80)
PROPOSED PROJECT:	"D" Process Line Construction/1.2 MM TPY Expansion

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PURPOSE OF APPLICATION:

Solvay is proposing to expand their soda ash (sodium carbonate) production capacity at their Green River Plant by approximately 1.2 million tons per year; from a current 2.40 MM TPY, up to a total 3.6 MM TPY. This production increase will be accomplished by constructing a full new trona processing and soda ash production train, the fourth such train at the facility. This new process line will be identified as "D" train.

Major equipment proposed for the project includes a new 50,000 ton covered ore storage building; the addition of new primary cone crusher and screening loop equipment; a 400 MM Btu/hr natural gas fired calciner; a 200 MM Btu/hr natural gas fired dryer; associated dissolving, filtering and evaporating equipment; a 100 MM Btu/hr natural gas fired boiler, and two new 10,000 ton (325,000 ft^3) capacity soda ash product storage silos. Also, the existing mine ventilation shaft will be converted to a second ore production shaft under this expansion, requiring drilling of a third shaft for the revised mine ventilation system.

Process Description

This plant produces soda ash product (sodium carbonate chemical: Na_2CO_3) from trona ore (sodium carbonate/bicarbonate mineral: $Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$), mined underground at the plant site. Current Wyoming Air Quality permits limit this plant to 2.4 MM TPY of soda ash production from no more than 3.8 MM TPY of trona ore. There currently are three separate processing units on plant, identified as the "A", "B" and "C" process trains, respectively. The "D" process train will follow conventional monohydrate soda ash production techniques, using the same basic production steps as the existing three units as described below.

Trona ore is mined underground at the site, hoisted to the surface and then conveyed to a building housing the primary screen. A new mining technique will be implemented at Solvay as part of this expansion, known as "long wall" mining. Ore from long wall mining is expected to be produced in larger size pieces, therefore Solvay is adding a new primary screening and cone crushing loop to the process as part of this expansion.

At the primary screen, run-of-mine (ROM) trona ore is separated into three fractions, with the largest pieces (> 3") recycled to the new primary cone crusher. The fine fraction (< ¼") goes directly to process, while the remaining mid-size fraction goes to a splitter where it can either go to secondary crushing, or to one of two enclosed ore storage buildings. The existing East Storage Building has a capacity of 90,000 tons, while the West Storage Building (to be constructed under this permit), is sized at 50,000 tons.

Trona reclaimed from ore storage, or mid-size fraction conveyed directly from the splitter, is sent to one of four hammermill secondary crushers in the main crusher building to produce pea size (< ¼") refinery feed. The mined trona ore is composed of approximately 85-90% trona mineral, with the remainder consisting primarily of sand and shale. Thus after crushing, the ore must be conveyed to the refinery process buildings for removal of these insoluble contaminants.

The first half of the process takes place in the **calciner/dissolver end**, where trona is chemically converted to sodium carbonate (process called calcining) and then dissolved in water to form "liquor". Calcining takes place in direct gas-fired rotary kilns, where the heat drives off the bicarbonate CO_2 and the water of hydration in the trona crystal. The calcined ore from the kiln outlet spill point is then dissolved in weak soda ash liquor, forming a strong soda ash solution of the soluble sodium carbonate.

The insoluble rock is left behind in the dissolution process, being separated from the liquor in a series of settling and filtering steps. The largest sand/shale particles drop out in a tank and are pulled out by a piece of equipment called a rake classifier. Then the liquor is fed to thickener tanks where the smaller particles settle and can be removed. Finally, the liquor passes through pressure filters to remove the last traces of solid residue.

In addition to insoluble rock, the trona ore is also contaminated with organic matter in varying degrees. This varying organic level causes the trona crystals to appear in color ranging from clear, through shades of yellow, and on to dark brown "root beer" trona. Thus the soda ash liquor also picks up this yellow tint, which must be removed to produce the desired product purity. Activated carbon is used to remove these organics, with this carbon being mixed in powdered form into the soda ash liquor prior to completing pressure filtering. The carbon adsorbs the soluble organic impurities, removing the "color" from the liquor, and the used carbon is picked up with other insolubles in the last of the filters.

The second half of the process takes place in the **evaporator/dryer end**, where the soda ash liquor is concentrated in steam heated triple-effect evaporators to drive off excess water from the liquor, producing purified soda ash crystals. The wet soda ash crystals are centrifuged to dewater them, and then the crystals are conveyed to dryer kilns. "A" and "B" trains have steam tube design dryers, while "C" and "D" trains utilize direct gas-fired rotary kilns. These dryers drive off the remaining free moisture, leaving the final granular soda ash product falling to conveyors at the spill end of the dryer units.

The product is then screened to remove oversize particles, and conveyed to storage silos to await shipment by bulk truck, bulk rail, or in bags. Existing storage capacity includes two 10,000 ton (325,000 ft^3) silos, and four 7,000 ton (225,000 ft^3) silos. Two additional 10,000 ton silos are proposed under this application.

Utility steam is provided for electricity generation and process heat by two 350 MM Btu/hr coal fired **process boilers**. Solvay will install an additional 100 MM Btu/hr natural gas fired boiler under this application, primarily to supply heat for the mine air ventilation system.

Project Emission Sources

Solvay's application indicates that there will be seven new emission points constructed under this project. The major process emission sources will include **(1)** an electrostatic precipitator on the exhaust of the new gas fired calciner (AQD #80), and **(2)** another electrostatic precipitator on the exhaust of the gas fired soda ash dryer (AQD #82). There will also be four housekeeping dust control systems, utilizing baghouses to capture dust from dry ore and soda ash conveyor handling and processing activities. These four systems are identified as AQD #'s 76, 79, 81 and 83. Finally, there will be a new 100 MM Btu/hr capacity natural gas fired boiler installed, identified as AQD #85, primarily for heating mine ventilation air.

In addition, Solvay intends to modify the existing "A", "B" and "C" calciners to increase their design short term production capacity from 162, up to 200 TPH trona feed. This increased capacity will be accomplished by replacing the existing drag conveyors on the spill end of the kilns, with new higher speed bucket elevators allowing more product removal capacity. Solvay feels that the firing capacity of these three existing calciners is sufficient to adequately calcine the increase trona ore throughput.

Another change planned under this project is the removal of the AQD #2b baghouse that currently services the East Storage Building ore reclaim system. AQD #46, another baghouse control system is located in the vicinity of the East Storage ore reclaim, and Solvay feels that this system has the capacity to absorb the load of the existing ore reclaim pick-up points. Thus Solvay will modify the AQD #46 industrial ventilation system to include these former AQD #2b system hoods.

AQD #47 baghouse control system, the control device for collecting dust emissions from the existing three hammermill crushers, will also be eliminated as part of this project. Solvay has excess capacity in the AQD #2a baghouse, and by modifying the industrial ventilation system of #2a, they intend to control the emission points from the existing three hammermills with this system. The #2a fan will not be changed, however, and that fan's exhaust air volume will simply be re-apportioned throughout the modified collection ductwork. With the same projected exhaust volume, the existing source #2a particulate emission rate will remain at the current level.

Also part of this project, Solvay plans to reduce permitted emissions in eleven existing plant baghouses by changing the basis on which the allowable limits are set. Solvay had estimated emissions from AQD #'s 6b, 10, 11, 14, 41, 44, 46, 64, and 65 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set on this basis in past permits. In this current application, Solvay is proposing to reduce the allowable for these nine sources to 0.01 gr/dscf. The emissions on two other units, AQD #50 "C" train dryer housekeeping and AQD #53 product silo reclaim baghouses, will do even better at 0.005 gr/dscf.

As additional trade-off for new particulate emissions, Solvay will reduce the permit limit on the two existing coal boilers (AQD #18 & 19) from 17.0, down to 5.0 pph (0.0056 gr/dscf) based on recent internal testing and evaluation of control equipment capability by the Solvay technical staff.

Also based on testing results, Solvay will reduce the permit limit on four process dryers (AQD #15, #26, #51 & #73). The particulate allowables for AQD #15 common stack for the "A" & "B" line steam tube dryers' electrostatic precipitators, and the AQD #73 meta-bisulfite dryer scrubber stack, will both be based on 0.015 gr/dscf. Mass emission test results on the AQD #26 Alkaten product dryer baghouse stack show it to operate below 0.006 gr/dscf, while the mass values for the AQD #51 "C" line gas fired dryer electrostatic precipitator stack work out to 0.008 gr/dscf outlet loading.

In another particulate trade-off measure, Solvay will commit to limiting operation of three coal handling baghouses (AQD #'s 10, 11 & 14), and one caustic lime delivery baghouse, to no more than 12 hours per day. These systems control emissions from coal or lime deliveries, which occur intermittently, only during the daytime hours.

Under May '96 permit MD-282, Solvay had permitted expansion of their existing sodium sulfite plant to include a meta-bisulfite (MBS) product variant, along with construction of a new combined product bagging facility. That permit considered installation of four product storage silos for the bagging machine feed, one for each of four products (MBS, sodium sulfite, Alkaten, and soda ash), with a bin vent baghouse assigned to each silo. Solvay subsequently decided that the new soda ash silo could be serviced by the existing AQD #53 main soda ash silo storage vent baghouse control system, thus the new planned bin vent for the bagging soda ash silo was no longer required. Therefore the MD-282 permitted source, AQD #69, was never built, and this analysis acknowledges removal of that source from the Green River plant emission inventory.

In addition to the elimination of AQD #69, Solvay recently notified the Division of other changes to the actual configuration of emission sources constructed under the MD-282 permit (5/29/97 letter). These changes included abandoning the former AQD #40 sulfite bagging system, and relocating that old baghouse for service on the new AQD #72 MBS process soda ash feed bin. Stack exhaust volume was revised for the product loading storage silo bin vents (AQD #'s 68, 70, 71 & 72), and as above, Solvay reduced allowable emissions from 0.02, down to 0.01 grains per dry standard cubic foot of exhaust (gr/dscf) for these four sources. The Division acknowledged that the MBS/bagging system revision proposal resulted in reduced potential emissions (6/27/97 letter), and informed Solvay that the allowable emission changes would be codified in this permit. Thus the emission calculations of this permit also incorporate these changes to the "Bagging Facility/MBS Plant".

This permit will also acknowledge the existence of nitrogen oxide and volatile organic compound emissions, from a small natural gas burner on the AQD #26 Alkaten product dryer. This source has existed since its installation under July '86 permit CT-643A, but identification of NO_x and VOC emissions from the source was just recognized in the preparation of this current application.

Solvay has also corrected the system exhaust volumes (flow rates) of a number of existing emission sources. These corrections are identified in the individual descriptions of existing sources modified under the application.

Finally, this application will formally consider the existence of VOC emissions from the mine vent system. The mine vent has existed at the plant from its inception, but it has only recently been determined such vents are the source of significant emissions. As noted previously, under this project Solvay will drill a new shaft for the revised mine configuration ventilation system, however emissions are not expected to vary significantly from the existing vent shaft.

REPORTED PROCESS RATES:

As indicated above, this expansion will produce approximately 1.2 million tons per year of monohydrate soda ash (137 TPH dryer production average for full year, 8760 hours operation). To yield that tonnage, the existing three calciners will each process a maximum of 200 TPH of trona ore, while the new "D" calciner will be designed for 275 tons per hour ore feed.

Solvay's maximum hourly process rates after completion of this expansion project are shown in Table A, along with a comparison between the annual production at full load, full year (8760 hrs) operation and the design capacity sought through the permit application.

Table A: Solvay Design Process Rates

Unit	Calciner Kilns: Trona Ore Feed Rate (TPH)	Calciner Kilns: Calcined Ore Production Rate (TPH)	Trona Ore Feed Rate Capacity @ Full Load (MMTPY)	Design Annual Trona Ore Feed Rate (MMTPY)
#17 "A" Calciner	200	147	1.752	1.577
#17 "B" Calciner	200	147	1.752	1.577
#48 "C" Calciner	200	147	1.752	1.577
#80 "D" Calciner	275	202	2.409	2.048
Totals	875	643	7.665	6.779

Unit	Dryer Kiln: Wet Crystal Feed Rate (TPH)	Dryer Kiln: Soda Ash Production Rate (TPH)	Soda Ash Production Capacity @ Full Load (MMTPY)	Design Annual Soda Ash Production (MMTPY)
#15 DR-1 Dryer	93	76	0.666	0.594
#15 DR-2 Dryer	93	76	0.666	0.594
#28 DR-4 Dryer	40	32	0.280	0.252
#51 DR-5 Dryer	150	122	1.069	0.962
#82 DR-6 Dryer	198	161	1.410	1.199
Totals	563	458	4.091	3.601

POLLUTANTS EMITTED:

Particulate matter (TSP/PM_{10}), nitrogen oxides (NO_x), carbon monoxide (CO) and volatile organic compounds (VOC's) are the major pollutants that will be emitted as a result of this project.

Regarding particulate, the stack emission control equipment is not 100% efficient at catching dust, therefore some particulate matter will be emitted in the form of trona or soda ash dust from the stacks of the trona calciner, the soda ash dryer, and from the housekeeping baghouses constructed under this project.

NO_x will be the primary pollutant coming from combustion of natural gas in the trona calciner, the soda ash dryer and the new 100 MM Btu/hr boiler. Carbon monoxide (CO) is also emitted from natural gas combustion, but because ambient standards are so much higher for this pollutant, it is not as important an emission in this analysis. Also emitted from natural gas combustion are trace amounts of unburned hydrocarbon fuel that slips through the burners, and the combustion products of fuel impurities such as ash and sulfur. The ash and sulfur content of the natural gas fuel is negligible and will result in inconsequential emission rates of particulate matter and sulfur dioxide. Carbon dioxide, the product of complete carbonaceous fuel combustion, will also be emitted from natural gas combustion, but CO_2 is not considered a pollutant of local concern at this point in time.

Volatile organic compound emissions (VOC's = non-methane, non-ethane organic compounds) have been found to be emitted from various trona processing operations, driven off from organic contaminants in the trona ore. The VOC emission components possibly originate from the oil shale that is mined around the edges of the trona ore deposits, or from organic contaminants within the trona ore, itself. The VOC's may contain individual pollutant species which are listed under Title III of the U.S. Clean Air Act Amendments of 1990, as hazardous air pollutants (HAP's).

Finally, there will be emissions coming from the mine air vent system, as VOC contaminated exhaust from the mining operation escapes to the atmosphere.

The applicant has reported that testing of the existing calciners has revealed CO, VOC, and HAP emissions due to the calcination process. As reported by the applicant, due to the extreme variability of the emission rates tested and the limited number of samples, a very conservative approach to determine maximum emission rates of these pollutants was utilized. A statistical analysis of stack test results was done to derive the expected average and maximum hourly emissions. The average emission rate was calculated, then to it is added 3 times the standard deviation. Statistically, this result depicts the maximum hourly emission rate with a confidence level of 99.7%.

EMISSION CONTROL MEASURES PROPOSED:

Solvay has not yet made a final selection of the control equipment that will be installed under this project, but they have specified the exhaust rates and emission control that these pieces of equipment will be designed to achieve. As a permit condition, the Division will require that these pieces of control equipment meet the design specifications and comply with the emission limits as considered in this permit analysis. Also Solvay will be required to supply details of the final equipment selection after the alternatives are considered.

Major emission sources proposed in this permit application include:

AQD #80 "D" Train Trona Ore Calciner Precipitator

The new trona calciner will be fired with natural gas, with a design firing capacity of 400 MM Btu/hr. The burner will be designed for "Low NO_x" performance, with a NO_x emission rate of 0.05 lb/MM Btu, or 20.00 pph. At the 275 TPH design trona feed rate of this unit, the process emission factor will be 0.073 lb/ton ore feed.

Solvay is proposing to use an electrostatic precipitator, designated source AQD #80, to control particulate emissions from this calciner stack. The ventilation system will be designed to handle 264,000 actual cubic feet per minute (95,300 dscfm) of exhaust through a 10'6" diameter stack (3,049 ft/min exit velocity). Solvay has certified that this precipitator will meet an outlet particulate loading of 0.015 grains per dry standard cubic foot of exhaust, which works out to 12.25 pounds per hour of particulate matter.

From plant testing on other similar sources, Solvay has projected maximum VOC emissions from trona based emissions and gas firing, of 1.94 pounds per ton of ore throughput. For the 275 maximum TPH process rate, this works out to 533.50 pph for this calciner.

CO emissions also exist from trona calcining, with some CO coming from the fuel combustion at the kiln burner, and a significant portion coming form partial combustion of the hydrocarbons driven off the trona ore in the hot environment of the calciner kiln. From plant testing on this sources, Solvay has projected maximum CO emissions from trona based emissions and gas firing, of 3.81 pounds per ton of ore throughput. For the proposed 275 TPH maximum process rate, this works out to 1047.75 pph for the calciner. The burner manufacturer guarantees a CO emission rate of 0.07 lb/MM Btu from fuel firing, or 28 pph for this 400 MM Btu/hr burner based on 46 ppmv CO concentration. This shows that over 97% of the total projected CO from calcining are tied to process throughput.

AQD #82 "D" Train Soda Ash Rotary Dryer Precipitator

The new soda ash dryer will be direct fired with natural gas, with a design firing capacity of 200 MM Btu/hr. The burner will be designed for "Low NO_x" performance designed to meet a NO_x emission rate of 0.15 lb/MM Btu, or 30.00 pph. At the 198 TPH design wet mono crystal feed rate of this unit, the process emission factor will be 0.152 lb/ton wet feed.

Solvay is proposing to use an electrostatic precipitator, designated source AQD #82, to control particulate emissions from this dryer stack. The ventilation system will be designed to handle 130,000 actual cubic feet per minute (40,200 dscfm) of exhaust through an 8 ft. diameter stack (2586 ft/min exit velocity). Solvay has certified that this precipitator will meet an outlet particulate loading of 0.010 grains per standard cubic foot of exhaust, which works out to 3.45 pounds per hour of particulate matter.

From plant testing on other similar sources, Solvay has projected maximum VOC emissions from natural gas firing, based the AP-42 Table 1.4-3 emission factor of 1.4 lb/MMCF of gas fired (83% of TOC) for "large industrial boilers". At a heating value of 1035 Btu/ft^3, the dryer burners will consume 193,237 CFH of fuel, working out to 0.27 pph for this dryer. Solvay's testing has indicated that the VOC contribution from the soda ash process material is negligible.

The burner manufacturer guarantees a CO emission rate from the AQD #82 soda ash dryer of 0.07 lb/MM Btu from fuel firing, or 14 pph for this 200 MM Btu/hr burner based on 42 ppmv CO concentration in the exhaust.

AQD #85 Gas Fired Boiler

Solvay is proposing to install a 100 MM Btu/hr natural gas fired boiler, designated source AQD #85, to be used primarily for supplying heat to the mine ventilation system. The boiler is rated to produce 100,000 pph of steam while burning 96,618 SCFH of natural gas fuel (H.V. ~1035 Btu/ft^3). This boiler will have a "Low NO_x" burner system with a guaranteed design NO_x emission rate of 0.038 lb/MM Btu. This type of performance is typically achieved with an elongated "Low NO_x" burner flame configuration, using flue gas recirculation and low excess air. Solvay notes that final design of the boiler is still incomplete, but they note that possible other design parameters include:

1) extended surface in the boiler convection section to improve boiler efficiency by reducing gas pressure drop and exit gas temperature,

2) water cooled front wall to prevent reradiation of energy from the refractory, to lower flame temperature and NO_x formation, and

3) staged burner fuel combustion to reduce NO_x formation in the in the combustion process.

Thus Solvay is certifying that this boiler will emit no more than 3.80 pounds per hour of NO_x.

Solvay burner manufacturer has also guaranteed CO emissions of 0.09 lb/MM Btu from this boiler, or 9.00 pounds per hour at the 100 MM Btu/hr design firing capacity based on 90 ppmv CO concentration in the exhaust.

The industrial ventilation system fan on this boiler will be designed for 42,000 actual cubic feet per minute (22,275 dscfm) of exhaust air, leading to a 3.0 ft. diameter outlet stack (5,942 ft/min exit velocity). Because it burns only natural gas, Solvay has projected minimal particulate emissions based again on AP-42 emission factors. The Table 1.4-1 emission factor for particulate on "large industrial boilers" is 5.0 lb/MMSCF. At the 96,618 CFH design fuel use rate, particulate emission work out to 0.48 pph for this dryer.

Solvay also projected VOC emissions from the boiler based on AP-42 emission factors from Table 1.4-3 for gas firing. At the 2.8 lb/MMCF factor for on "small industrial boilers" (48% of TOC), and 96,618 CFH design fuel use rate, VOC emissions work out to 0.27 pph for this dryer.

Although AP-42 also provides an emission factor for SO_2, the Division is satisfied that the specified sulfur content of normal pipeline gas is trivial and sulfur dioxide emissions are negligible.

Housekeeping emission sources proposed in this permit application include:

AQD #76 Primary Screening Baghouse

Solvay is proposing to use a standard baghouse and industrial ventilation system, designated source AQD #76, to collect trona dust from vents associated with the new primary ore screens and the discharge of that system to distribution conveyor belts. This industrial ventilation system fan will be designed for 36,000 actual cubic feet per minute (28,600 dscfm) of exhaust air, leading to a 3'8" ft. diameter baghouse stack (3,409) ft/min exit velocity). Solvay has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust, which works out to 2.45 pounds per hour of particulate matter.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #79 Main Crusher Building Hammermill Feed Housekeeping Baghouse

Solvay is proposing to use a standard baghouse and industrial ventilation system, designated source AQD #79, to collect trona dust from transfer points on the discharge end of the conveyor system carrying the reclaim ore from the West Ore Storage Building to the hammermills in the main crusher building. This industrial ventilation system fan will be designed for 12,250 actual cubic feet per minute (9,800 dscfm) of exhaust air, leading to a 2'1" diameter baghouse stack (3,594) ft/min exit velocity). Solvay has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust, which works out to 0.84 pounds per hour of particulate matter.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>AQD #81 Soda Ash Dryer Area Housekeeping Baghouse</u>

Solvay is proposing to use a standard baghouse and industrial ventilation system, designated source AQD #81, to collect soda ash dust from transfer points and screens in the soda ash dryer product handling area of the main process plant. This industrial ventilation system fan will be designed for 10,000 actual cubic feet per minute (5,800 dscfm) of exhaust air, leading to a 1'8" diameter baghouse stack (4,584 ft/min exit velocity). Solvay has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust, which works out to 0.50 pounds per hour of particulate matter.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>AQD #83 Product Storage Silo Feed Area Housekeeping Baghouse</u>

Solvay is proposing to use a standard baghouse and industrial ventilation system, designated source AQD #83, to collect soda ash dust from bin vents and product transfer points at the top of the two new soda ash storage silos. This industrial ventilation system fan will be designed for 7,500 actual cubic feet per minute (4,750 dscfm) of exhaust air, leading to a 1'8" diameter baghouse stack (3,438 ft/min exit velocity. Solvay has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust, which works out to 0.29 pounds per hour of particulate matter.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>Existing process sources which will be modified under this expansion</u> include:

<u>AQD #15 Dryer 1 & 2 Scrubber Stack</u>

Solvay currently controls particulate emissions on the DR-1 and DR-2 steam tube dryer exhaust streams using twin model 59/126 Type VVO Ducon venturi scrubbers, with the common exhaust stack designated source AQD #15. The industrial ventilation fan for this system is designed for 83,100 actual cubic feet per minute (33,750 dscfm) of exhaust air, leading to a 6 ft. diameter baghouse stack (2,939 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #15 scrubber stack by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #15 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 6.80 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this scrubber stack exhaust will meet an outlet emission loading of 0.015 grains/dscf of exhaust. At the currently specified 33,750 dscfm, this works out to a revised allowable particulate emission rate of 4.34 pounds per hour.

The stack also emits NO_x emissions limited to 1.20 pph. From plant testing on other similar sources, Solvay has determined total VOC emissions from this boiler to be fuel related, thus based on AP-42 emission factors, the unit emits 0.06 pph of VOC. No changes are planned for the burner operation or control equipment, thus these gaseous pollutant emission rates will not differ from the current projection.

AQD #17 "A" & "B" Trona Ore Calciner Precipitators Common Stack

The AQD #17 stack emits the exhaust from both the "A" and "B" train trona calciners, currently rated to process 162 TPH of trona ore feed, each. As noted earlier, Solvay plans to increase that design feed rate up to 200 TPH trona feed on each unit by installing new higher speed bucket elevators at the outlet to improve product removal capacity. The burners on each of these calciners have an existing design firing capacity of 200 MM Btu/hr, however Solvay has indicated that they feel these units can operate over-design up to 250 MM Btu/hr in this service. Thus Solvay feels that the firing capacity of these burners is sufficient to adequately calcine the increased trona ore throughput. The burners are designed for "Low NO_x" performance and they had been rated for a NO_x emission rate of 0.05 lb/MM Btu. Subsequent internal testing has indicated to Solvay that a NO_x control performance of 0.06 lb/MM Btu, is more appropriate. Thus each calciner will move from 10 pph NO_x emissions (0.05 @ 200), up to 15 pph (0.06 @ 250), and the AQD #17 stack will have an allowable NO_x emission limit of 30.00 pph, based on both "A" and "B" calciner emissions. This works out to a 0.075 lb/ton ore feed factor considering the new 200 TPH design trona feed rate for each unit.

There are existing electrostatic precipitators for particulate emission control on each of these calciners. The revised ventilation system for the AQD #17 stack will be designed to handle 312,000 actual cubic feet per minute (120,424 dscfm) of exhaust through a 12 ft. diameter stack (2,759 ft/min exit velocity). Internal Solvay testing has indicated that the precipitators can handle this increased ore throughput, and still meet the current 22.30 pph particulate emission limit. Thus the outlet grain loading will be 0.022 grains per standard cubic foot of exhaust.

From plant testing on this source, Solvay has projected maximum VOC emissions from trona based emissions and gas firing, of 1.94 pounds per ton of ore throughput. For the former 162 TPH process rate, this works out to 314.28 pph for each calciner, while for the proposed 200 TPH maximum process rate, this works out to 388.00 pph for each unit. Thus the AQD #17 stack will now have a VOC emission rate of 776.00 pph.

CO emissions also exist from trona calcining, with some CO coming from the fuel combustion at the kiln burner, and a significant portion coming form partial combustion of the hydrocarbons driven off the trona ore in the hot environment of the calciner kiln. From plant testing on this sources, Solvay has projected maximum CO emissions from trona based emissions and gas firing, of 3.81 pounds per ton of ore throughput. For the former 162 TPH process rate, this works out to 617.22 pph for each calciner, while for the proposed 200 TPH maximum process rate, this works out to 762.00 pph for each unit. Thus the AQD #17 stack will now have a CO emission rate of 1524.00 pph.

AQD #18 & #19 Coal Boiler Scrubber & Precipitator Control Systems

Solvay currently operates a Flakt Spray Tower Flue Gas Desulfurization (FGD) Scrubbers and Flakt Type FAA 5x32-66120-2 Electrostatic Precipitators to control emissions from the exhaust of the 350 MM Btu plant coal fired boilers, designated sources AQD #18 and AQD #19. The industrial ventilation fans for these systems are designed for 143,676 actual cubic feet per minute (103,500 dscfm) of exhaust air, leading to 7'4" diameter precipitator stacks (3,480 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted particulate emissions from these stacks as additional trade-off for new emission sources, based on recent internal testing and evaluation of control equipment capability by the Solvay technical staff. Solvay had projected emissions from the boilers at 17.00 pph each, and that emission limit was included in past permits. In this current application, Solvay has certified that the boiler stacks will now meet a particulate emission rate of 5.00 pounds per hour, each. This works out to an outlet loading of approximately 0.0056 grains per dry standard cubic foot of exhaust (gr/dscf).

The stacks also emit SO_2 and NO_x emission limited to 70 and 245 pph, respectively. From plant testing on other similar sources, Solvay has determined total VOC emissions from this boiler to be fuel related, thus based on AP-42 emission factors, the unit emits 0.50 pph of VOC. No changes are planned for the boiler operation or control equipment, thus these gaseous pollutant emission rates will not differ from the current projection.

AQD #26 Alkaten Product Dryer Baghouse

Solvay currently has a model PSTR-D-10-81 Peabody baghouse and industrial ventilation system to control particulate emissions from the existing Alkaten product dryer, designated source AQD #26. The industrial ventilation fan for this system is designed for 15,600 actual cubic feet per minute (11,700 dscfm) of exhaust air, leading to a 2'5" diameter baghouse stack (4,318 ft/min exit velocity). As mentioned in the project description, Solvay has recently identified NO_x emissions from a small 2.6 MM Btu/hr gas burner that provides heat to the Alkaten dried trona product kiln. Solvay has estimated NO_x emissions from AQD #26 at 0.25 pph, based on AP-42 for natural gas burning. Solvay has determined total VOC emissions from this dryer to be fuel related, thus based on AP-42 emission factors, they calculate that the unit emits 0.01 pph of VOC. This permit will codify the existence of these fuel related gaseous pollutants from this emission source at the Solvay plant.

No changes are planned for the Alkaten kiln operation, but Solvay had previously projected an emission rate from the Alkaten kiln operation at 1.10 pph; which was included in past permits as the AQD #26 particulate emission limit. Solvay has tested this stack, and from those results, the company is proposing that the Alkaten kiln stack now meet a revised particulate emission limit of 0.55 pounds per hour. This works out to an outlet loading of approximately 0.0055 grains per dry standard cubic foot of exhaust (gr/dscf).

AQD #47 Main Crusher Control Baghouse

Solvay currently has a model 640J-1020-TRH Mikro Pulsaire baghouse and industrial ventilation system to collect trona dust from transfer points and vents associated with the operation of the three existing hammermill crushers in the main crusher building, designated source AQD #47. As noted earlier, this source will be eliminated as part of this project, and by modifying the industrial ventilation system of source #2a, Solvay will control the emission points from these hammermills with the excess capacity of that #2a system.

AQD #48 "C" Trona Ore Calciner Precipitator

The "C" train trona calciner is currently rated to process 162 TPH of trona ore feed, but as noted earlier, Solvay plans to increase that design feed rate up to 200 TPH by installing new higher speed bucket elevators at the outlet to improve product removal capacity. The burners on this calciner have an existing design firing capacity of 200 MM Btu/hr, however Solvay has indicated that they feel this unit can operate over-design up to 250 MM Btu/hr in this service. Thus Solvay feels that the firing capacity of these burners is sufficient to adequately calcine the increased trona ore throughput. The burners are designed for "Low NO_x" performance and as above, they had been rated for a NO_x emission rate of 0.05 lb/MM Btu. However, a NO_x control performance of 0.06 lb/MM Btu is now considered more appropriate. Thus the "C" calciner throughput change will increase NO_x emissions from 10 pph (0.05 @ 200), up to 15.00 pph (0.06 @ 250) for the AQD #48 stack. This works out to a 0.075 lb/ton ore feed factor considering the proposed 200 TPH design trona feed rate for this unit.

There is an existing electrostatic precipitator for particulate emission control on AQD #48, designed to handle 156,000 actual cubic feet per minute (60,212 dscfm) of exhaust through a 10'6" diameter stack (1,802 ft/min exit velocity). Internal Solvay testing has indicated that the precipitator can handle this increased ore throughput, and still meet the current 9.30 pph particulate emission limit. Thus the outlet grain loading will be 0.018 grains per standard cubic foot of exhaust.

From plant testing on this source, Solvay has projected maximum VOC emissions from trona based emissions and gas firing, of 1.94 pounds per ton of ore throughput. For the former 162 TPH process rate, this works out to 314.28 pph for each calciner, while for the proposed 200 TPH maximum process rate, the VOC emission rate from AQD #48 will be 388.00 pph.

CO emissions also exist from trona calcining, with some CO coming from the fuel combustion at the kiln burner, and a significant portion coming form partial combustion of the hydrocarbons driven off the trona ore in the hot environment of the calciner kiln. From plant testing on this sources, Solvay has projected maximum CO emissions from trona based emissions and gas firing, of 3.81 pounds per ton of ore throughput. For the former 162 TPH process rate, this works out to 617.22 pph for each calciner, while for the proposed 200 TPH maximum process rate, the CO emission rate from AQD #48 will be 762.00 pph.

AQD #51 Dryer 5 Scrubber Stack

Solvay currently controls particulate emissions on the DR-5 gas fired dryer exhaust stream using a model FAA 100-AL Flakt electrostatic precipitator, designated source AQD #51. The industrial ventilation fan for this system is designed for 100,000 actual cubic feet per minute (35,000 dscfm) of exhaust air, leading to an 8 ft. diameter baghouse stack (1,989 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #51 stack by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #51 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 4.80 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this precipitator stack exhaust will meet an outlet emission loading of 0.008 grains/dscf of exhaust. At the currently specified 35,000 dscfm, this works out to a revised allowable particulate emission rate of 2.40 pounds per hour.

The stack also emits NO_x emissions limited to 18.00 pph. From plant testing on other similar sources, Solvay has determined total VOC emissions from this boiler to be fuel related, thus based on AP-42 emission factors, the unit emits 0.28 pph of VOC. No changes are planned for the burner operation or control equipment, thus these gaseous pollutant emission rates will not differ from the current projection.

AQD #73 MBS Scrubber Stack

Solvay currently controls particulate emissions on the meta-bisulfite dryer exhaust stack using a Ducon Oriclone venturi scrubber, designated source AQD #73. The industrial ventilation fan for this system is designed for 10,500 actual cubic feet per minute (7,000 dscfm) of exhaust air, leading to a 2 ft. diameter baghouse stack (3,342 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #73 scrubber stack by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #73 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 1.20 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this scrubber stack exhaust will meet an outlet emission loading of 0.015 grains/dscf of exhaust. At the currently specified 7,000 dscfm, this works out to a revised allowable particulate emission rate of 0.90 pounds per hour.

Existing housekeeping sources which will be modified under this expansion include:

AQD #2a Ore Crusher Building Housekeeping Baghouse

Solvay currently has a model PMTR-10-544T Peabody baghouse and industrial ventilation system to collect soda ash dust from transfer points associated with the ore crusher building, designated source AQD #2a. As mentioned above, Solvay modify the industrial ventilation system of this source to control the emission points from the former AQD #47 hammermill collection baghouse, which will be eliminated as part of the project. The #2a fan will not be changed, however, and that fan's exhaust air volume will simply be re-apportioned throughout the modified collection ductwork. The industrial ventilation fan for the #2a system is designed for 35,000 actual cubic feet per minute (28,000 dscfm) of exhaust air, leading to a 3'6" diameter baghouse stack (3,638 ft/min exit velocity). With the same projected exhaust volume, the existing source #2a particulate emission rate will remain at the current level of 1.60 pph. This works out to an outlet loading of approximately 0.0067 grains per dry standard cubic foot of exhaust (gr/dscf).

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #6b Product Storage Silo Reclaim Area Housekeeping Baghouse

Solvay currently has a model PS-10-256TE Peabody baghouse and industrial ventilation system to collect soda ash dust from transfer points associated with the soda ash reclaim operation from the existing soda ash storage silos, designated source AQD #6b. The industrial ventilation fan for this system is designed for 7,500 actual cubic feet per minute (5,900 dscfm) of exhaust air, leading to a 2.20 ft. diameter baghouse stack (1,973 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #6b baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #6b at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 1.40 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 5,900 dscfm, this works out to a revised allowable particulate emission rate of 0.51 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #10 Coal Crushing & Storage Area Baghouse

Solvay currently has a model PSTR-10-64D Peabody baghouse and industrial ventilation system to collect coal dust from the coal crushing and storage building, designated source AQD #10. The industrial ventilation fan for this system is designed for 3,300 actual cubic feet per minute (3,000 dscfm) of exhaust air, leading to a 2.0 ft. diameter baghouse stack (1,050 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #10 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #10 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.60 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 3,000 dscfm, this works out to a revised allowable particulate emission rate of 0.26 pounds per hour.

In another measure to reduce annual particulate emissions and demonstrate compliance with ambient standards, Solvay has proposed to limit the usage of this AQD #10 baghouse to 12 hours per day. Coal deliveries are not continuous and the baghouse is not needed full time. Thus 4380 hours of operation are considered in this analysis, which reduces the annual particulate emissions from AQD #10 to 0.57 TPY.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #11 Coal Transfer Station Housekeeping Baghouse

Solvay currently has a model PSTR-10-64D Peabody baghouse and industrial ventilation system to collect coal dust from transfer points associated with the coal reclaim operation from the existing enclosed coal storage building, designated source AQD #11. The industrial ventilation fan for this system is designed for 3,200 actual cubic feet per minute (2,500 dscfm) of exhaust air, leading to a 1.80 ft. diameter baghouse stack (1,258 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #11 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #11 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.60 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 2,500 dscfm, this works out to a revised allowable particulate emission rate of 0.21 pounds per hour.

In another measure to reduce annual particulate emissions and demonstrate compliance with ambient standards, Solvay has proposed to limit the usage of this AQD #11 baghouse to 12 hours per day. Coal deliveries are not continuous and the baghouse is not needed full time. Thus 4380 hours of operation are considered in this analysis, which reduces the annual particulate emissions from AQD #11 to 0.46 TPY.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #14 Coal Bunker Area Housekeeping Baghouse

Solvay currently has a model PS-10-100D Peabody baghouse and industrial ventilation system to collect coal dust from bin vents and transfer points associated with the coal handling operation in the existing boiler coal bunkers, designated source AQD #14. The industrial ventilation fan for this system is designed for 5,400 actual cubic feet per minute (4,275 dscfm) of exhaust air, leading to a 1'5" diameter baghouse stack (3,426 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #14 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #14 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 1.00 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 4,275 dscfm, this works out to a revised allowable particulate emission rate of 0.37 pounds per hour.

In another measure to reduce annual particulate emissions and demonstrate compliance with ambient standards, Solvay has proposed to limit the usage of this AQD #14 baghouse to 12 hours per day. Coal deliveries are not continuous and the baghouse is not needed full time. Thus 4380 hours of operation are considered in this analysis, which reduces the annual particulate emissions from AQD #14 to 0.81 TPY.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #41 Bulk Sodium Sulfite Loadout Area Housekeeping Baghouse

Solvay currently has a model 6-360-36-84S Dust Control Systems baghouse and industrial ventilation system to collect dust from bin vents and transfer points associated with the bulk sodium sulfite loadout operations, designated source AQD #41. The industrial ventilation fan for this system is designed for 2,510 actual cubic feet per minute (2,250 dscfm) of exhaust air, leading to a 1.0 ft. diameter baghouse stack (3,196 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #41 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #41 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.40 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 2,250 dscfm, this works out to a revised allowable particulate emission rate of 0.19 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #44 Caustic Lime Delivery Bin Vent Baghouse

Solvay currently has a model 495-8-20 Mikropulsaire baghouse and industrial ventilation system to collect dust from the pneumatic delivery of lime to the caustic plant lime silo bin vent, designated source AQD #44. The industrial ventilation fan for this system is designed for 2,630 actual cubic feet per minute (2,100 dscfm) of exhaust air, leading to a 1 ft. diameter baghouse stack (3,349 ft/min exit velocity).

As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #44 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #44 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.90 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 2,100 dscfm, this works out to a revised allowable particulate emission rate of 0.18 pounds per hour.

In another measure to reduce annual particulate emissions and demonstrate compliance with ambient standards, Solvay has proposed to limit the usage of this AQD #44 baghouse to 12 hours per day. Lime deliveries are not continuous and the baghouse is not needed full time. Thus 4380 hours of operation are considered in this analysis, which reduces the annual particulate emissions from AQD #44 to 0.39 TPY.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>AQD #46 East Ore Storage Building Reclaim Baghouse</u>

Solvay currently has a model 420-CL-029B Mikro Pulsaire baghouse and industrial ventilation system to collect trona dust from transfer points associated with the ore reclaim operation from the existing east ore storage building, designated source AQD #46. As noted earlier, Solvay will eliminate baghouse AQD #2b as part of the project, with AQD #46 system absorbing the load of the existing AQD #2b pick-up points. Solvay feels that the AQD #46 industrial ventilation system has the capacity to add these points without sacrificing system control efficiency, and still maintain emissions within allowable limits.

This industrial ventilation system fan will be designed for 10,500 actual cubic feet per minute (8,275 dscfm) of exhaust air, leading to a 2.20 ft. diameter baghouse stack (2,762 ft/min exit velocity). As mentioned in the project description, Solvay has also committed to reducing permitted emissions from the AQD #46 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #46 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 1.20 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 8,275 dscfm, this works out to a revised allowable particulate emission rate of 0.71 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>AQD #50 "C" Train Dryer Area Housekeeping Baghouse</u>

Solvay currently has a model 2805-10-20-TRH-C Mikro Pulsaire baghouse and industrial ventilation system to collect dust from transfer points associated with the "C" train dryer area soda ash handling operations, designated source AQD #50. The industrial ventilation fan for this system is designed for 26,000 actual cubic feet per minute (16,250 dscfm) of exhaust air, leading to a 4'6" diameter baghouse stack (1,635 ft/min exit velocity). As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #50 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #50 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 2.10 pph on this basis (system exhaust volume was specified differently in the past). Solvay has tested this stack, and from those results, the company is proposing that this dryer area soda ash handling baghouse stack now meet a revised particulate emission limit of 0.70 pounds per hour. This works out to an outlet loading of approximately 0.0050 grains per dry standard cubic foot of exhaust (gr/dscf).

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>AQD #53 Product Storage Silo Discharge Area Housekeeping Baghouse</u>

Solvay currently has a model 138D-10-20-TRH-C Mikro Pulsaire baghouse and industrial ventilation system to collect soda ash dust from the product transfer points in the discharge area at the bottom of the existing soda ash storage, designated source AQD #50. As noted earlier, Solvay will eliminate baghouse AQD #69 as part of the project, with AQD #53 system absorbing the load of the existing AQD #69 pick-up points. Solvay feels that the AQD #50 industrial ventilation system has the capacity to control these additional points without sacrificing system control efficiency, and still maintain emissions within allowable limits.

This industrial ventilation system fan will be designed for 13,175 actual cubic feet per minute (10,500 dscfm) of exhaust air, leading to a 2.8 ft. diameter baghouse stack (2140 ft/min exit velocity). As mentioned in the project description, Solvay has also committed to reducing permitted emissions from the AQD #53 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #50 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 1.10 pph on this basis (system exhaust volume was specified differently in the past). Solvay has tested this stack, and from those results, the company is proposing that this product silo reclaim baghouse stack now meet a revised particulate emission limit of 0.45 pounds per hour. This works out to an outlet loading of approximately 0.0050 grains per dry standard cubic foot of exhaust (gr/dscf).

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

<u>AQD #64 Sulfite Blending Drumming Bin Vent Baghouse</u>

Solvay currently has a model 16S-6-30B Mikro Pulsaire baghouse and industrial ventilation system to collect dust from the sulfite blending drumming bin vent, designated source AQD #64. This industrial ventilation system fan is designed for 1,130 actual cubic feet per minute (900 dscfm) of exhaust air, leading to a 6 inch diameter baghouse stack (4,583 ft/min exit velocity). As mentioned in the project description, Solvay has also committed to reducing permitted emissions from the AQD #64 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #64 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.15 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01

grains/dscf of exhaust. At the currently specified 900 dscfm, this works out to a revised allowable particulate emission rate of 0.08 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #65 Sulfite Blending Bagging Machine Vent Baghouse

Solvay currently has a model PS-5-16-C Peabody baghouse and industrial ventilation system to collect dust from the sulfite blending bagging machine vent, designated source AQD #65. This industrial ventilation system fan is designed for 400 actual cubic feet per minute (325 dscfm) of exhaust air, leading to an 8 inch diameter baghouse stack (382 ft/min exit velocity). As mentioned in the project description, Solvay has also committed to reducing permitted emissions from the AQD #65 baghouse by changing the basis on which the allowable limits are set. In past permits, Solvay had estimated emissions from AQD #65 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.06 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 325 dscfm, this works out to a revised allowable particulate emission rate of 0.03 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #68 Combined Product Bagging Machine Trona Silo Housekeeping Baghouse

Under permit MD-282 Solvay proposed using a model 81S-10-20 Mikro Pulsaire bin vent baghouse and industrial ventilation system, designated source AQD #68, to collect dust from the vent of the trona silo feeding the combined product bagging machine. This industrial ventilation system fan is designed for 5,277 actual cubic feet per minute (4,145 dscfm) of exhaust air, leading to a 1.17' x 0.98' rectangular baghouse stack (4,602 ft/min exit velocity).

As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #68 baghouse by changing the basis on which the allowable limits are set. For MD-282, Solvay estimated emissions from AQD #68 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.41 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 4,145 dscfm, this works out to a revised allowable particulate emission rate of 0.36 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #70 Combined Product Bagging Machine Sulfite Silo Bin Vent Baghouse

Under permit MD-282 Solvay proposed using a model 64S-10-20 Mikro Pulsaire bin vent baghouse and industrial ventilation system, designated source AQD #70, to collect dust from the vent of the sodium sulfite silo feeding the combined product bagging machine. This industrial ventilation system fan is designed for 4,021 actual cubic feet per minute (3,159 dscfm) of exhaust air, leading to a 1.63' x 0.84' rectangular baghouse stack (2,937 ft/min exit velocity).

As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #70 baghouse by changing the basis on which the allowable limits are set. For MD-282, Solvay estimated emissions from AQD #70 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.41 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 3,159 dscfm, this works out to a revised allowable particulate emission rate of 0.27 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #71 Combined Product Bagging Machine MBS Silo Bin Vent Baghouse

Under permit MD-282 Solvay proposed using a model 64S-10-20 Mikro Pulsaire bin vent baghouse and industrial ventilation system, designated source AQD #71, to collect dust from the vent of the meta-bisulfite (MBS) silo feeding the combined product bagging machine. This industrial ventilation system fan is designed for 4,021 actual cubic feet per minute (3,159 dscfm) of exhaust air, leading to a 1.63' x 0.84' rectangular baghouse stack (2,937 ft/min exit velocity).

As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #71 baghouse by changing the basis on which the allowable limits are set. For MD-282, Solvay estimated emissions from AQD #71 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.41 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 3,159 dscfm, this works out to a revised allowable particulate emission rate of 0.27 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

AQD #72 MBS Process Soda Ash Feed Bin Vent Baghouse

Under permit MD-282 Solvay proposed using a model 48BV36 Smoot bin vent baghouse and industrial ventilation system, designated source AQD #72, to collect dust from the vent of the MBS silo feeding the combined product bagging machine. As noted earlier, Solvay will eliminate baghouse AQD #40 as part of the project, with that source's old 25S-8-20TR Mikro Pulsaire baghouse being transferred for service to the AQD new #72 system. This industrial ventilation system fan is designed for 1,300 actual cubic feet per minute (820 dscfm) of exhaust air, leading to an 8" diameter baghouse stack (3,724 ft/min exit velocity).

As mentioned in the project description, Solvay has committed to reducing permitted emissions from the AQD #72 baghouse by changing the basis on which the allowable limits are set. For MD-282, Solvay estimated emissions from AQD #72 at 0.02 grains per dry standard cubic foot of exhaust (gr/dscf), and particulate emission limits were set at 0.14 pph on this basis (system exhaust volume was specified differently in the past). In this current application, Solvay is proposing to reduce the allowable for this source and has certified that this baghouse will meet an outlet emission loading of 0.01 grains/dscf of exhaust. At the currently specified 820 dscfm, this works out to a revised allowable particulate emission rate of 0.07 pounds per hour.

From plant testing on other similar sources, Solvay has predicted that total VOC emissions from trona based emissions will be negligible for this baghouse.

POLLUTANT EMISSION RATES:

Table I, attached as an appendix to the end of this analysis, lists all of the particulate, SO_2, NO_x and VOC emission sources at the Solvay plant. Table B summarizes the changes as shown in Table I (numbers vary slightly due to rounding).

Table B: Solvay Trona Plant Pollutant Emission Rate Changes (TPY)

Source	PM_{10}	SO_2	NO_x	VOC
Existing Solvay Trona Plant	482	618	2369	4639
Proposed "D" Line Expansion	89	0	236	2339
Current Proposed Modifications	-181	0	67	969
Bagging/MBS Modifications	-5	0	0	0
Totals	385	618	2672	7947

As can be seen from the table, Solvay currently is allowed to emit 482 TPY of particulate, 618 TPY of sulfur dioxide and 2369 TPY of nitrogen oxides. Not considered in past permitting actions, but also existing at the plant is a projected 4639 TPY of VOC emissions. Solvay plans on adding about 89 TPY of particulate, 236 TPY of NO_x, and 2339 TPY of VOC from equipment associated installed with the new "D" process line. Adjustments to the allowables of existing equipment and other small modifications results in the elimination of about 186 TPY of particulate, but add 67 TPY NO_x, and 969 TPY VOC's. Therefore after construction of the new equipment, the plant will be permitted a total emission about 385 TPY of particulate, 618 TPY of SO_2, 2672 TPY of NO_x and 7947 TPY of VOC's.

As noted earlier, the VOC's emitted from the trona plant contain individual pollutant species which are listed under Title III of the U.S. Clean Air Act Amendments of 1990, as hazardous air pollutants (HAP's). Table II breaks down the VOC emissions from the Solvay Plant, by emission source and by pollutant. Of the 1,814 pph VOC's projected from the plant, approximately 464 pph (2,033 TPY) of those compounds (26%) are HAP species. The HAP pollutants are emitted as 27 chemical compounds, with the largest single emission being represented by the pollutant 1,3 butadiene, at 118.51 pph (519.1 TPY). This is followed by ten other compounds with short term emissions greater than 10 pounds per hour. In order of magnitude, these are: 68.39 pph (299.6 TPY) of trichloroethylene, 54.59 pph (239.1 TPY) of xylene, 53.19 pph (233.0 TPY) of benzene, 36.54 pph (160.1 TPY) of 2-butanone, 32.15 pph (160.1 TPY) of hexane, 28.34 pph (124.1 TPY) of toluene, 23.32 pph (102.1 TPY) of 1,1,1 trichloroethane, 14.32 pph (62.7 TPY) of styrene, 12.11 pph (53.0 TPY) of ethylbenzene, and 10.72 pph (47.0 TPY) of acrylonitrile. According to Solvay's emission inventory, other pollutants emitted at rates greater than one pound per hour are methylene chloride, acetaldehyde, and acrolein.

NEW SOURCE PERFORMANCE STANDARDS (NSPS):

Subpart OOO

The trona plant handles sodium compounds, which are defined as "non-metallic minerals" under Subpart OOO of the NSPS section of the Wyoming Air Quality Standards and Regulations. Since the plant crushes and mills these sodium minerals, it is considered a "non-metallic mineral processing plant" under the definition in the regulation. Subpart OOO is applicable to "each crusher, grinding mill, screening operation, bucket elevator, belt conveyor, storage bin and truck/rail loadout". Therefore the baghouse dust collection systems proposed under this project are subject to the limitations of the regulation, including opacity and emission limits. Under Subpart OOO the particulate emissions from the plant housekeeping baghouses must be held to within 0.05 grams per dry standard cubic meter (g/dscm) of baghouse exhaust and must have visible emissions within 7% opacity.

The 0.05 g/dscm rate is equivalent to 0.02 grains per dscf. Since all newly constructed or modified housekeeping dust control systems will meet an emission limit of 0.01 gr/dscf, the particulate ceiling of the regulation is met. A permit condition will insure that Solvay meets these emission and opacity limits.

Subpart Dc

The Division has reviewed the applicability of NSPS Subpart Dc and finds that the section applies to the proposed 100 MM Btu/hr gas fired boiler because the unit is a new facility sized between 10 and 100 MM Btu/hr. Under Subpart Dc, standards for particulate and sulfur dioxide emissions apply only to those boilers that fire coal. The only Subpart Dc requirements for those boilers that fire other fuels are administrative notification requirements contained in subparagraph 60.48c. Under that section the owner/operator of a new boiler is required to submit notification of the dates of construction, anticipated and actual start-up, with confirmation of the design heat input capacity and fuels to be combusted. This permit will contain State of Wyoming requirements that mandate compliance with these provisions.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT):

Solvay has conducted a "Top Down" BACT review of emission controls for this plant expansion, and the Division has determined that they have selected the most stringent controls available for all proposed operations.

Particulate Emissions

★ Calciner ★

As noted earlier, Solvay is proposing to use an electrostatic precipitator, designated source AQD #80, to control particulate emissions from this calciner stack. Solvay has certified that this precipitator will meet an outlet particulate loading of 0.015 grains per dry standard cubic foot of exhaust. At the exhaust rate of 95,300 dscfm, this works out to a particulate emission rate of 12.25 pounds per hour. With a design trona feed rate of 275 TPH, this calciner particulate emission rate then works out to a factor of 0.045 lb/ton of trona feed.

The Division's review into particulate controls from other recent applications in the trona patch, show that particulate emissions from existing trona calciners run from 0.06 to 0.47 pounds per ton of ore throughput. The latest permit issued for new construction of a similar type source (OCI trona plant, CT-1299, May '97), considered 0.047 lb/ton of trona feed as representing BACT. Thus at 0.045 pounds per ton; this new calciner will operate well below existing equipment of similar type and function. Therefore, the proposal represents the state-of-the-art control, and the Division proposes to accept Solvay's proposal as representing BACT for particulate control on this calciner.

★ Dryer ★

As noted earlier, Solvay is proposing to use another electrostatic precipitator, designated source AQD #82, to control particulate emissions from the new gas fired soda ash dryer stack. Solvay has certified that this precipitator will meet an outlet particulate loading of 0.010 grains per standard cubic foot of exhaust. At the exhaust rate of 40,200 dscfm, this works out to a particulate emission rate of 3.45 pounds per hour. With a design soda ash production rate of 161 TPH, this dryer particulate emission then works out to 0.021 lb/ton of soda ash production.

~~The Division has recently permitted a trona plant gas fired dryer (Tg Soda Ash, CT-~~ 1321, Oct. '97) which set particulate emissions of 0.010 gr/dscf, with a design exhaust rate of 39,032 dscfm. Thus the mass emission for that application is 3.35 pph of particulate matter. That dryer is a 100 TPH soda ash production sized unit, therefore the emission factor works out 0.034 lb/ton of soda ash.

In the OCI permit cited above (CT-1299, May '97) emissions for a similar type dryer were permitted at 0.041 lb/ton of soda ash, with 0.017 gr/dscf outlet loading, as representing BACT.

Recent Wyoming Air Quality determinations have shown that anything under 0.02 gr/scf is excellent performance, therefore at 0.010 grains per standard cubic foot of exhaust, this new dryer will operate equal to or below current emissions levels for similar existing equipment. The Division proposes to accept the proposal as representing BACT for particulate control on this dryer.

★ Boiler ★

Solvay is proposing to fire the AQD #85 boiler on natural gas fuel, with particulate emissions calculated based on the AP-42 Table 1.4-1 emission factor of 5.0 lb/MM ft^3 of fuel fired, specified for "Large Industrial Boilers". At 100 MM Btu/hr firing rate, using 1035 Btu/ft^3 heating value, the boiler will burn 96,618 CFH of natural gas fuel. This works out to a particulate emission of 0.48 pph. Solvay has proposed no additional particulate emission control.

The Division is aware that natural gas has inherently low particulate emissions, compared with other fuels. Because this boiler will use a low emitting fuel, and because the resultant particulate emissions are insignificant, the Division will accept Solvay's proposal as representing BACT for particulate control in this case.

★ Housekeeping Dust Collection Systems ★

Solvay is proposing to use standard baghouse/industrial ventilation systems to serve housekeeping dust collection needs throughout the new process train. Solvay has certified that these baghouse systems will meet an outlet particulate emission loading of 0.01 grains/dscf of exhaust.

As mentioned earlier, current NSPS Standards for housekeeping dust collection systems limit particulate emissions to 0.02 grains per dscf. Therefore the Solvay proposal represents excellent performance at half the NSPS standard. The Division will accept this level of efficiency as reflecting the state of the art for baghouse emission control, and agree that it satisfies BACT for this pollutant.

Nitrogen Oxide Emissions

★ Calciner ★

As previously described, Solvay is proposing to fire the new AQD #80 trona calciner with natural gas, at a design firing rate of 400 MM Btu/hr. Natural gas has inherently lower NO_x emissions than alternative fuels such as coal or oil. In addition, the burner will be designed for "Low NO_x" performance designed to meet a NO_x emission rate of 0.05 lb/MM Btu, or 20.0 pph. This performance represents the state of the art for this type of emission control, and the Division has determined that the Solvay proposal satisfies BACT for this pollutant.

★ Dryer ★

As previously described, Solvay is proposing to fire the new AQD #82 trona dryer with natural gas, at a design firing rate of 200 MM Btu/hr. As above, natural gas has inherently lower NO_x emissions than alternative fuels, but the burner that was finally selected will be a North American "Flame Grid" unit designed for 0.15 lb/MM Btu performance.

The reason that 0.05 lb/MM Btu performance is not being proposed for this dryer is that investigation has shown that such an ultra low achieving burner would require the use of a high alloy "iconel" liner to attain the required dryer temperatures. Review then showed that such a liner would be subject to deterioration, which could result in metal contamination levels of the soda ash product, which are unacceptable to customers. The next best burner available is the 0.15 lb/MM Btu North American burner cited above. The Division has reviewed Solvay's justification, and given the technical limitations due to contamination concerns, has determined that this performance represents the state of the art for this type of emission control. Thus the dryer will meet a NO_x mass emission rate of 30.0 pph, and the Division has determined that this performance satisfies BACT for this pollutant in a soda ash dryer application.

★ Boiler ★

The burner that Solvay is proposing to use on the AQD #85 boiler will achieve "Low NO_x" performance of 0.038 lb/MM Btu.

As part of the application, Solvay conducted a BACT review of NO_x emission controls for natural gas fired package boilers by reviewing post combustion controls, including Selective Catalytic Reduction (SCR) and Selective Non-Catalytic Reduction (SNCR).

SCR uses ammonia in the presence of vanadium pentoxide catalyst to convert NO_x to nitrogen and oxygen. Solvay rejected SCR technology because of potential environmental impact and product contamination through the use of ammonia, because of the expense and RCRA hazardous waste potential of the heavy metal catalyst, and because of the high 500-800° F temperature flue gas requirement for the process.

According to Solvay's application, SNCR requires even higher flue gas temperatures of 1600-1800° F to reduce NO_x, and has been demonstrated on combined cycle natural gas fired, using ammonia as the reagent. Once again, Solvay has concerns with potential environmental impact and product contamination from ammonia, and with the ultra-high required flue gas temperatures.

The most stringent NO_x emission rate found for recent past boiler BACT analyses, is 0.015 lb/MM Btu achieved on a 380 MM Btu/hr gas fired electric generator in the San Francisco Bay Area. This rate was achieved using selective catalytic reduction (SCR) in combination with low NO_x burners and flue gas recirculation. SCR has the potential for adverse environmental impacts because of possible impact from ammonia emissions and the hazardous waste potential of the catalyst. Other analyses also have noted the fluctuating nature of boiler operations cause varying catalyst bed temperatures not experienced in the relatively stable operation of an electric generator. Thus there are concerns that these fluctuations would reduce the control efficiency of this technique considerably below the theoretical projections. From the Division's experience it has been found that the cost of exotic NO_x control has not been worth the emissions reduction benefit, and it has not been shown that any of these technologies offers reliable control efficiencies significantly better than proposed.

Recent natural gas fired boiler BACT determinations include acceptance of 0.10 lb/MM Btu emission guarantees for General Chemical's 490 MM Btu/hr unit (CT-1199; February '96) and FMC's 315 MM Btu/hr unit (CT-1045A; November '95). SF Phosphate's 350 MM Btu/hr unit was permitted at 0.14 lb/MM Btu (CT-1043; October, '93) based on limited hours of full firing. Texasgulf's 200 MM Btu/hr unit (CT-945; September '91) also was permitted at 0.14 lb/MM Btu, representing BACT at that time.

Solvay cites investigation showing that the most stringent control they found for a "similar" boiler type facility was 0.043 lb/MM Btu on a 62.5 MM Btu/hr Kern County, California installation. From the performance of other recently Wyoming permitted boiler installations, it is clear that Solvay's 0.038 lb/MM Btu proposal is well below the current actual industry standard for this region. Thus, it is concluded that Solvay's projected emission rate represents the lowest achievable NO_x emission rate the Division is aware of for this type of natural gas fired boiler, and the Division is proposing to accept Solvay's preferred alternative of low NO_x burners operating at 0.038 lb/MM Btu.

Volatile Organic Compound Emissions

★ Calciner ★

As noted earlier, volatile organic compound emissions are defined as non-methane, non-ethane organic compounds. VOC's have been found to be emitted from various trona processing operations, and it is suspected that a majority of these VOC's are driven off from organic contaminants in the trona ore and possibly from the oil shale that is mined around the edges of the trona ore deposits. As the point at which heat is first applied to the trona ore, the calciner stacks have been shown to be a primary emission points for VOC emissions in the soda ash industry.

There are five physical techniques that the Division is aware of that may control VOC emissions. They are 1) combustion/oxidation, 2) absorption, 3) adsorption, 4) condensation, and 5) fine particulate capture. Solvay has considered these control options as described below. Analyses of emission control costs were calculated based on the AQD #80 projected average VOC emission rate of 210.65 pph, rather than the maximum 533.5 pph VOC rate of the stack. The average emission rate of 210.65 pph is based on the average tested results from the existing calciners projected to the new calciner on a lb/ton ore feed basis. The 533.5 pph maximum instantaneous rate is based on the addition of the 3 standard deviations to represent the maximum hourly rate. The applicant and the Division consider the average expected emission rate more representative to calculate control costs as this is the expected rate on an annual basis and control costs are estimated on an annual average basis.

Combustion/Oxidation

The process of combustion (also referred to as oxidation) is frequently used to control the emissions of organic compounds. At sufficiently high temperatures and adequate residence times, any hydrocarbon can be converted to carbon dioxide and water by combustion. Combustion devices are often simple devices, typically consisting of a burner, which ignites the organic fuel, and a chamber which provides adequate residence time for the oxidation of the hydrocarbon to be completed. Equipment used for this service can be divided into three categories; flares, thermal incinerators and catalytic incinerators.

Thermal decomposition (burning) of the VOC's by a flare was investigated by Solvay and found to be technically feasible, however, the heating value of the organic gasses in the calciner exhaust is too low to burn independently. Therefore natural gas would be required as a supplemental fuel. Section 3.4.3 of the application contains the cost effectiveness calculations in dollars per ton of VOC control. The cost effectiveness for the flare system was reported as $9,159 per ton of VOC, to achieve a projected 98% control efficiency. Solvay found that costs of such an option would be prohibitive.

In contrast to a flare, during an incineration process waste gasses pass over or around a burner flame into a closed residence chamber, where combustion is completed. Solvay found that although thermal incinerators (also called thermal oxidizers or afterburners) were technically feasible, the control efficiency was no greater than for catalytic incinerators, which have lower annual costs.

10 MM

Catalytic oxidation is similar to thermal oxidation, except that combustion of the waste gasses takes place in the presence of a catalyst that reduces the required temperature to ensure complete combustion. With lower temperatures, comes lower supplemental fuel use costs. Solvay found that catalytic oxidation achieves 95% control of VOC's, but the catalyst has a finite life, and must be replaced on a regular cycle. The replacement frequency is increased in dirtier exhaust streams, such as calciner exhaust. The cost effectiveness for the catalytic oxidation system was reported as $10,858 per ton of VOC. Solvay found that costs of such an option would be prohibitive to their operation.

24
200
4800

2.4 TON
11
24
24
$26.4 M/D

Absorption

Absorption refers to contacting the waste gasses with a liquid so that the organics dissolve into or chemically react with that liquid. Contact is usually made in a wet scrubber. Solvay found that although the technique is technically feasible for controlling organic material, it was also considered technically unreasonable for their application because no known application of absorption has been applied to calciners at trona plants. They felt that the costs of developing absorptions applications for the process would be prohibitive, and they did not further evaluate the process.

In an earlier application for VOC control, Solvay found that scrubbing was infeasible because contact with four scrubber vendors (Ceilcote Air Pollution Control, Westport Environmental Systems, Croll-Reynolds Company, and Ducon Environmental Services) resulted in the conclusion that a wet scrubber was not effective for removal of VOC's due to the low molecular weight, high volatility and low solubility of the compounds involved.

Carbon Adsorption

Adsorption is a surface phenomenon, where VOC's are selectively adsorbed into microscopic pores on the surface of the adsorbent material. Activated carbon is the most widely used material that is used for adsorption. Regarding this technique, once again Solvay found that although they considered the technique to be technically feasible for controlling organic material, it was also considered technically unreasonable for their application because carbon adsorption systems have not been applied to calciners at trona plants. They felt that the costs of developing absorptions applications for the process would be prohibitive, and they did not further evaluate the process. The cost effectiveness for the carbon absorption system was reported as $5,006 per ton of VOC. Based on the technical questions and the low cost effectiveness Solvay found the cost to be prohibitive.

Condensation

Vapor condensation involves separating organic materials from the gas stream by phase change from gas to liquid, either by increasing pressure, or more commonly by reducing the temperature of the gas stream in a cooled condenser chamber (refrigeration frequently required). According to Solvay, condensers generally require inlet concentrations of thousands of parts per million, in order to achieve significant removal efficiencies (>80%), while the VOC concentration in the Solvay calciner would be much lower. As with other considered technologies, there are no existing applications at trona plants, and Solvay states that their cost estimate indicates that the option is cost prohibitive. The cost effectiveness for the condensation system was reported as $6,664 per ton of VOC.

Fine Particulate Capture

Fine particulate capture is achieved with a wet electrostatic precipitator (WESP). Vendor literature on the subject indicates that such devices are capable of capturing a "blue haze", which is the caused from condensation of VOC emissions into fine particulate. Solvay was requested to investigate this option and they confirmed that WESP's were introduced to reduce emissions of sub-micron size particles, including condensible organics, especially those that are soluble. They considered the installation of a WESP as the primary control device, and as such, the unit would have to handle particulate from calcining, as well as the VOC's from the unit.

WESP's require process gas be cooled to the range of 110-120° F in order to achieve the desired condensation, thus the gas stream must be pretreated to saturation in a quencher, producing a dense mist of very small droplets. The droplets absorb the contaminants in the exhaust stream at varying efficiency (dependent on species, solubility & temperature), and then pass into cylindrical collecting tubes. Each of the tubes has a high voltage discharge electrode at the center, which forms an electric corona field. Particles passing through this field attain an electric charge, and migrate towards the oppositely charged walls of the tube. The fine water droplets also are charged and move toward the grounded wall, forming a film of liquid that runs down the tube, providing continual cleaning of the tube walls.

In their evaluation, Solvay assumed that only the condensible organics would be collected, while non-condensible organics including some VOC's, would not be controlled. To illustrate their point, they cited the case of 1,3 butadiene, which has a boiling point of 24° F. Thus when passing through a WESP at the 110-120° F operating temperature of that unit, 1,3 butadiene would not be condensed. Solvay also noted that many of the VOC compounds found in calciner exhaust are not water soluble, therefore they would not be absorbed by the water mist in the WESP.

Solvay noted that WESP's have a high water demand (2-6 gal/hr estimate for each 1000 acfm of flue gas). For the 264,000 acfm projected from the AQD #80 calciner, this works out to 528-1,584 gallons per hour for this application. For this water discharge, Solvay envisioned the necessity of an evaporation pond to handle the volume, and they felt that at least a portion of those VOC's would simply be emitted to the atmosphere at that point, without some treatment of this water.

They noted that the inlet loading to control device is projected at over 100,000 pph of trona dust, and indicated that the WESP was not designed to be used in high inlet grain loading processes. Solvay calculated that this 100,000 pph of dust would require 28,000 gal/hr of water to dissolve the dust, which is more than 17 times the amount of water the WESP is designed to handle.

Solvay worried about precipitation of calcium and magnesium carbonates on the walls of WESP, at higher pH levels of the alkaline trona dust. They did not feel that a water wash would be effective in cleaning such a unit of this potential scaling.

Thus Solvay found that the use of WESP's as a primary control device on trona calcining operations, was not technically feasible. They did not look at the use of WESP's as a secondary VOC control, after conventional particulate removal techniques, but they did note that the effectiveness of WESP technology on the VOC stream present in the calciner exhaust was problematic.

Conclusion

Solvay concludes that while some of the control options discussed are technically feasible, none are practical. Based on the economic analysis contained in the application, Solvay asserts that the feasible options would be too costly to warrant consideration for the purpose of VOC control for the calciner exhaust stream. No calciner VOC controls are listed the EPA's BACT/LAER Clearinghouse data base. They assert that the VOC concentrations in the calciner exhaust stream are quite low, and they propose that no add-on VOC control be accepted as BACT for this project.

Solvay's cost estimates for the control options range from $5,006 to $10,858 per ton of VOC removed. The Division has reviewed those costs and determined that it is currently not cost effective to control VOC emissions from the calciner stacks in the trona processing industry. Therefore, the Division proposes to accept Solvay's proposal of no add-on control as representing BACT for calciner VOC emissions.

★ Dryer ★

Gas fired soda ash dryers typically show dramatically lower VOC emissions than calciners, and since it has not been shown to be cost effective for controlling larger emission quantities, the Division will not require VOC control on the smaller volumes of emissions generated from the dryer, either.

★ Boiler ★

VOC emissions from natural gas fired boilers have been determined to be fuel related, calculated based on the AP-42 Table 1.4-3 emission factor of 2.78 lb/MM ft^3 of fuel fired specified for "Small Industrial Boilers" (48% of 5.8 lb/MM ft^3 total organic carbon). At 100 MM Btu/hr firing rate, using 1035 Btu/ft^3 heating value, the boiler will burn 96,618 CFH of natural gas fuel. This works out to a VOC emission of 0.27 pph. Solvay is proposing no add on control for this boiler.

The predicted boiler VOC emissions are inherently low, compared with other fuels. Because this boiler will use a low emitting fuel, and because the resultant VOC emissions are insignificant, the Division will accept Solvay's proposal as representing BACT and require no additional VOC control in this case.

★ Housekeeping Dust Collection Systems ★

Once again, typical VOC emission rates from other plant stacks have been shown to be quite low, so the Division has determined that no VOC control will be required on these housekeeping sources, either.

★ Mine Exhaust ★

The mine vent has existed at the plant from its inception, but it has only recently been determined that the vent is a source of significant VOC emissions. Solvay projects approximately 115 pph of VOC emissions from their proposed operation, based on testing of the existing mine ventilation shaft showing a VOC concentration of 0.0113 gr/dscf. The new mine exhaust shaft will have an air flow of approximately 1,500,000 acfm (1.2 MM dscfm), which is more than five times the exhaust rate of the new calciner, while the VOC concentration is approximately 25% of that from the AQD #48 stack. Since it has been shown to be uneconomical to control stronger concentrations at lower flows, it is clearly also uneconomical to control VOC from the mine vent.

Hazardous Air Pollutant Emissions

Because HAP's are a subset of VOC's, and because the cost of controlling VOC's has been determined to be excessive, by the same reasoning the Division will require no add-on control for HAP emissions.

Carbon Monoxide Emissions

★ Calciner ★

The new AQD #80 trona calciner natural gas ***burner*** will have design CO emission rates of 28.00 pph, based on a manufacturer's projection of 46 ppm CO outlet concentration in the burner exhaust. This is only the "fuel related" portion of CO emissions, coming from combustion of natural gas the burner. At the design firing rate of 400 MM Btu/hr, the 28.00 pph works out to 0.07 lb per million Btu fired. In any combustion process, there is a natural trade off between NO_x and CO emissions, with CO emission rising (incomplete hydrocarbon combustion) as excess combustion air is reduced to control NO_x emissions. Nitrogen oxides are the more critical of the two pollutants from the human health and welfare perspective, and given the "Low NO_x" performance of the burner, the Division is satisfied that the predicted CO performance of the proposed AQD #80 burner represents the state of the art for this type of emission source, and acceptably satisfies BACT for CO.

Another aspect of calciner CO evaluation revolves around "process related" CO emissions. All of the CO that exits the stack, does not necessarily come from fuel combustion in the burner. Some CO has been shown to be generated by partial combustion of the VOC's driven off the trona ore in the hot atmosphere at the front end of the calcining kiln, or from the chemical breakdown of the bicarbonate portion of the trona ore crystal. Another trona industry operator (Texasgulf) conducted diagnostic testing on new calciner burners in 1993, after finding that their stack emissions were well above the carbon monoxide limit of 8.00 pph set into a permit for those new gas burners. Samples were taken from ports in the ceiling of the burner fire box and from the burner throat connecting the fire box to the calciner kiln. These samples showed very low CO concentrations, in the range of 2 - 5 ppmv. Additional sampling showed CO concentrations around 170 ppmv in the calciner stack exhaust. There were no VOC's found in the samples taken from the burner end of the kiln, but there were significant concentrations of these compounds found in the stack (77 ppmv). Based on this work, it is clear that a portion of the CO emission is a function of ore composition, with no emission reductions available from the calciner equipment, itself.

Solvay has conducted CO testing on existing calciners which indicates a carbon monoxide emission rate of 3.81 pounds per ton of ore. At the 275 TPH feed rate to AQD #80, this calculates to 1,047.75 pph (4,589 TPY) from the calciner stack. As the Division is convinced it is not technically feasible to control this trona based CO emission, no add-on control requirement for BACT of calciner CO emissions is proposed.

★ Dryer ★

The new AQD #82 trona dryer natural gas burner will have design burner "fuel related" CO emission rates of 14.00 pph, based on a manufacturer's projection of 42 ppm CO outlet concentration in the burner exhaust. At the design firing rate of 200 MM Btu/hr, this works out to 0.07 lb/MM Btu. There are no hydrocarbons or bicarbonate compound in the wet monohydrate crystal feed to form process material related CO emissions in a soda ash dryer.

Because of the inverse relationship between NO_x and CO emissions, carbon monoxide emissions will be somewhat higher from the AQD #82 dryer stack with its "Low NO_x" burner performance, than they would be from a conventional burner. As noted above, nitrogen oxides are the more critical of the two pollutants from the human health and welfare perspective, thus the Division is again satisfied that the predicted CO performance of the proposed AQD #82 "Low NO_x" burner acceptably satisfies BACT for CO.

★ Boiler ★

The new AQD #85 natural gas boiler will have a design burner CO emission rate of 9.0 pph, based on a manufacturer's projection of 90 ppm CO outlet concentration in the burner exhaust. At the design firing rate of 100 MM Btu/hr, this works out to 0.09 lb/MM Btu.

Again, because of the inverse relationship between NO_x and CO emissions, carbon monoxide emissions will be somewhat higher from the AQD #85 boiler stack with its "Low NO_x" burner performance, than they would be from a conventional burner. As noted above, nitrogen oxides are the more critical of the two pollutants from the human health and welfare perspective, thus the Division is again satisfied that the predicted CO performance of the proposed AQD #85 "Low NO_x" burner acceptably satisfies BACT for CO.

Control Equipment Specifications

Because the details of the control equipment specifications have not been provided in the application, final review of the effectiveness of these controls is limited. The Division will set allowable emission limits for pollutants based on design emission parameters provided by Solvay. However, as a BACT permit condition, the Division will require Solvay to provide the plans and specifications of each of these control devices for final approval, prior to installation.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD):

Table I of this analysis shows the particulate, sulfur dioxide, nitrogen oxide and volatile organic emissions from the existing equipment at the Solvay trona plant, along with the proposed emissions from the "D" train expansion. As can be seen, the existing Solvay plant is a "major emitting facility" under paragraph 24(a)(I)(b) of the Wyoming Air Quality Standards & Regulations because it has the potential to emit more than 250 TPY of regulated pollutants (482 TPY of TSP, 618 TPY of SO_2, 2,369 TPY of NO_x and 4,639 TPY of VOC's).

If an operator undertakes a "major modification" of a "major emitting facility", then PSD regulations are applicable. Paragraph 24(a)(x) of the regulations defines a "major modification" as any change which results in a "significant net emissions increase". Paragraph 24(a)(xii) allows for a "contemporaneous decrease in actual emissions" to offset increases used for calculating a "significant net emissions increase". Paragraph 24(a)(xix) of the regulations requires the Division to use a representative two-year period preceding the emissions change to determine "actual emissions" of an emission source.

♦ PSD Particulate Accounting ♦

Permit changes occurring after the 1977 effective date of the PSD regulations at the Solvay plant include the following permits and waivers:

Permit Number	Date Issued	Project Description
CT-234	Jul '79	initial construction of a 1 MM TPY soda ash plant
CT-234A	Dec '81	AQD #16 stack parameter modifications
CT-234A2 (OP-154)	Sep '84	address as-built modifications to 1 MM TPY plant
CT-643	Sep '85	initial design for construction of the Alkaten plant
CT-643A (OP-181)	Jul '86	revised plans for construction of the Alkaten plant
MD-117 (OP-257)	Feb '90	caustic/sodium sulfite facility & DR-4 fluid bed drier
MD-132 (OP-258)	Nov '90	"C" soda ash product line → 2 MM TPY plant capacity
T-200 Waiver	Feb '92	construct T-200 Alkaten storage bin & AQD #54 baghouse
CT-946	Mar '92	calcined trona project (project was mostly abandoned)
MD-229	Jun '95	conversion of "A" & "B" trona calciners to gas firing
MD-282	May '96	construction of a meta-bisulfite production facility

Because this plant was not constructed until 1982, after the 1977 effective date of the PSD regulations, all of the emissions from the facility consume PSD increment.

The MD-282 permit analysis provides an update of the PSD particulate status for the Solvay Green River plant, showing 481.51 TPY of particulate emissions permitted from the plant. A total of 480.53 TPY had been considered in the most recent previous PSD increment consumption analysis, therefore at that time, 0.98 TPY remained toward the "net emissions increase" calculation for PSD particulate increment consumption at the Solvay plant.

As noted, under this project Solvay is proposing to retire ore reclaim baghouse AQD #2b, sulfite product bagging baghouse AQD #40, and crusher building baghouse AQD #47 from service; eliminating the particulate allowable limits for these sources from the plant emission inventory. They also will abandon plans for the MD-282 permitted AQD #69 soda ash bagging silo bin vent, but no credit accrues under PSD regulations for the AQD #69 action because this source was never constructed, thus actual emissions over the last two years were zero.

As further particulate emission reduction, Solvay is proposing to reduce plant allowable particulate emissions from existing source AQD #'s 6b, 10, 11, 14, 41, 44, 46, 64 and 65 by basing emission loadings on 0.01 gr/dscf predicted emissions, rather than on 0.02 gr/dscf as had been considered for these units in past permits. The AQD #15 soda ash dryer stack and the AQD #73 meta-bisulfite dryer stack will take a slightly lower reduction, down to 0.015 gr/dscf. They also planned to reduce plant allowable particulate emissions from five other existing plant sources based on internal testing showing lower actual emissions than the former allowable emission limits. The allowables for the two coal boilers (AQD #18 & 19), the AQD #26 Alkaten dryer, the AQD #50 "C" train dryer area housekeeping baghouse, and the AQD #51 silo reclaim baghouse will all be set under 0.006 gr/dscf, while the testing on the "C" train AQD #51 gas fired dryer showed that an emission rate of 0.008 gr/dscf is most appropriate.

In this application, Solvay is also proposing to reduce plant allowable particulate emissions from four sources permitted under the latest permit, MD-282, but not yet constructed. These sources are AQD #'s 68, 70, 71 and 72, and the reductions would again be accomplished by basing emission loadings on 0.01 gr/dscf predicted emissions, rather than on 0.02 gr/dscf. As with AQD #69, no credit accrues under PSD regulations for this action because these baghouses were never constructed, thus actual emissions over the last two years were zero.

The accounting of the particulate PSD credit due Solvay is shown in Table C.

Table C: Solvay Actual Particulate Emissions Offset Credit					
Emission Sources	Operating Hours			Emission Credit	
	Affected Years	Hours	2 Year Average	actual pph	actual TPY
AQD #2b	1995-96	8406/8639	8523	0.06	0.26
AQD #6b	1995-96	3120/7464	5282	0.49	1.30
AQD #10	1995-96	1535/1149	1342	0.28	0.19
AQD #11	1995-96	1535/1149	1342	0.28	0.19
AQD #14	1995-96	1145/1149	1147	0.46	0.26
AQD #15	1995-96	8359/8712	8536	3.52	15.02
AQD #18	1995-96	8548/8666	8607	11.12	47.85
AQD #19	1995-96	8611/8650	8631	9.41	40.61
AQD #26	1995-96	8280/8184	8232	0.76	3.13
AQD #40	1995-96	3120/2098	2609	0.30	0.39
AQD #41	1995-96	256/308	282	0.40	0.06
AQD #44	1995-96	1649/ 822	1236	0.90	0.56
AQD #46	1995-96	8161/8060	8111	1.20	4.87
AQD #47	1995-96	8161/8060	8111	2.70	10.95
AQD #50	1995-96	8280/8193	8237	0.49	2.02
AQD #51	1995-96	8280/8193	8237	0.30	1.24
AQD #53	1995-96	3120/7464	5292	1.10	2.91
AQD #64	1995-96	3120/1350	2235	0.15	0.17
AQD #65	1995-96	3120/1350	2235	0.06	0.07
AQD #68	1995-96	-0- / -0-	-0-	0.41	0.00
AQD #70	1995-96	-0- / -0-	-0-	0.41	0.00
AQD #71	1995-96	-0- / -0-	-0-	0.41	0.00
AQD #72	1995-96	-0- / -0-	-0-	0.14	0.00
AQD #73	1995-96	-0- / -0-	-0-	0.14	0.00

Under PSD regulations, Solvay can receive PSD credit for reducing "actual" particulate emissions at the plant. As shown in Table D however, for several of the of these stacks (6b, 10, 11, 14, 15, 41, 50, 51, 64 & 65), the revised allowable particulate emission rate is higher than the average actual emissions for the previous two years. Accordingly, no credit can be given under PSD regulations for the particulate matter emission change on these stacks, because there is no decrease in "actual emissions".

Table D: Solvay Particulate Emissions Changes; No PSD Credit Available (TPY)

Source	Average Actual Emissions		Permitted Emission		Net Change	
	2 Year Avg	Record Year	Existing	Modified	Permitted	Actual
AQD #6b	1.30	'95-96	6.13	2.23	-3.90	0.93
AQD #10	0.19	'95-96	2.63	0.57 α	-2.06	0.38
AQD #11	0.19	'95-96	2.63	0.46 α	-2.17	0.27
AQD #14	0.26	'95-96	4.38	0.81 α	-3.57	0.55
AQD #15	15.02	'95-96	29.78	19.01	-10.77	3.99
AQD #41	0.06	'95-96	1.75	0.83	-0.92	0.77
AQD #50	2.02	'95-96	9.20	3.07	-6.13	1.05
AQD #51	1.24	'95-96	21.02	10.51	-10.51	9.27
AQD #64	0.17	'95-96	0.66	0.35	-0.31	0.18
AQD #65	0.07	'95-96	0.26	0.13	-0.13	0.06

α = Sources will operate on a schedule of 12 hours/day, therefore annual emissions are based on one half of a year, or 4380 hours operation

With this accounting, the net particulate PSD change for Solvay additions to the plant from all applicable permits is shown in Table E. As can be seen the "contemporaneous decreases in actual emissions" do not offset the increases in PSD increment consuming sources proposed at the Solvay Plant, resulting in a net emissions increase of 31.33 TPY for PSD purposes on this "D" Train expansion project.

Table E: Solvay PSD Net Emissions Changes (Particulate TPY)						
Source	Average Actual Emissions		Permitted Emission		Net Change	
	2 Year Avg	Record Year	Existing	Modified	Permitted	Actual
Contemporaneous Decreases						
AQD #2b	0.26	'95-96	0.88	0.00	-0.88	-0.26
AQD #18	47.85	'95-96	74.46	21.90	-52.56	-25.95
AQD #19	40.61	'95-96	74.46	21.90	-52.56	-18.71
AQD #26	3.13	'95-96	4.82	2.41	-2.41	-0.72
AQD #40	0.39	'95-96	1.31	0.00	-1.31	-0.39
AQD #44	0.56	'95-96	3.94	0.39 α	-3.55	-0.17
AQD #46	4.87	'95-96	5.26	3.11	-2.15	-1.76
AQD #47	10.95	'95-96	22.34	0.00	-22.34	-10.95
Total Decreases	108.62	n.a.	187.47	49.71	-137.76	-58.91
PSD Increases						
"D" Train Expansion	0.00	n.a.	0.00	89.26	89.26	89.26
Total Increases	0.00	n.a.	0.00	89.26	89.26	89.26
Subtotal, Increment Consuming Emissions This Project					-48.50	30.35
Total Increment Consuming Emissions Considered in Last Analysis (MD-282)						481.51
Subtotal Solvay Increment Consuming Emissions						511.86
Subtract Emissions Considered in Previous Increment Analysis (CT-946)						480.53
Net Particulate Emissions Change (since last PSD Analysis)						31.33
α = Sources will operate on a schedule of 12 hours/day, therefore annual emissions are based on one half of a year, or 4380 hours operation						

As can be seen, the "net emissions increase" for this project, per PSD rules, is 31.33 TPY, based on the actual emissions reductions compared to the potential emission increases. However, with the reduction in allowable emissions established under this proposed permit, the total allowable particulate emissions from the Solvay Plant are 384.8 TPY, down from the 481.5 TPY previously permitted, as shown in Table I of this analysis. All of the 384.8 TPY of particulate emission consume PSD increment.

♦ PSD Nitrogen Oxide Accounting ♦

Permit changes occurring after the 1977 effective date of the PSD regulations at the Solvay plant include the following permits and waivers:

Permit Number	Date Issued	Project Description
CT-234	Jul '79	initial construction of a 1 MM TPY soda ash plant
CT-234A	Dec '81	AQD #16 stack parameter modifications
CT-234A2 (OP-154)	Sep '84	address as-built modifications to 1 MM TPY plant
CT-643	Sep '85	initial design for construction of the Alkaten plant
CT-643A (OP-181)	Jul '86	revised plans for construction of the Alkaten plant
MD-117 (OP-257)	Feb '90	caustic/sodium sulfite facility & DR-4 fluid bed drier
MD-132 (OP-258)	Nov '90	"C" soda ash product line → 2 MM TPY plant capacity
T-200 Waiver	Feb '92	construct T-200 Alkaten storage bin & AQD #54 baghouse
CT-946	Mar '92	calcined trona project (project was mostly abandoned)
MD-229	Jun '95	conversion of "A" & "B" trona calciners to gas firing
MD-282	May '96	construction of a meta-bisulfite production facility

The NO_x increments were not effective until February '88 (increments established 2/8/88; minor source baseline date for Wyoming triggered 2/26/88), therefore under PSD regulation, emissions from MD-117 and subsequent permits, are the only emissions counted when assessing NO_x increment consumption.

NO_x emission sources constructed after the 1988 NO_x baseline date include the AQD #33 sulfite sulfur burner (1.50 pph), the AQD #48 "C" ore calciner (10.00 pph), the AQD #51 DR-5 soda ash dryer (18.00 pph), the AQD #73 MBS product dryer (0.15 pph), and twin 6 MM Btu/hr supplemental heat duct burners in the inlet ducts of the "A" & "B" line steam tube dryers which exhaust to the AQD #15 stack (1.20 pph). Totaling these emissions results in 30.85 pph, or 135.12 TPY NO_x increment consumption.

Solvay did accumulate a credit for converting their "A" & "B" calciners to gas under MD-229 in 1995, the Division has determined that they did not "use" that credit at that time because the new sources constructed under that project did not result in a "significant" increase, thus the project was not subject to PSD regulations. Under MD-292, the company elected not to "use" the NO_x credit to offset sources constructed for the MBS plant. The term for "contemporaneous" use of a decrease is defined by Section 24(a)(xii)(B) as five years from the date that actual emissions were reduced. As the A" & "B" calciner gas conversion was completed and operation began in October '95, while Solvay's current application was received in June '97, they are within the regulatory time frame to use that emission credit.

The accounting of the NO_x PSD credit due Solvay is shown in Table F.

Table F: Solvay Actual NO_x Emissions Offset Credit

Emission Sources	Operating Hours			Emission Credit	
	Affected Years	Hours	2 Year Average	actual pph	actual TPY
Nitrogen Oxides					
AQD #17 gas conversion	1993-94	8430/8575	8503	161.00	684.49

As noted previously, under this permit, Solvay intends to increase the trona ore throughput and adjust the predicted burner NO_x emission performance up to 0.06 lb/MM Btu, based on test results on the calciners exhausting to AQD #17 and AQD #48 stacks. AQD #17 will increase allowable NO_x emissions by 10.00 pph, while AQD #48 will increase allowable NO_x by another 5.00 pph, for a total increase of 15.00 pph, or 65.70 TPY. Actual emissions for the two sources for the most recent two years of available data are: 66.18 TPY for AQD #17 (15.53 @ 8523 average hours operation 1995-1996), and 31.31 TPY for AQD #48 (7.72 @ 8111 average hours operation 1995-1996).

New sources proposed for the "D" calciner train (AQD #80 calciner, AQD #82 dryer, AQD #85 gas boiler) add another 53.80 pph, or 235.64 TPY NO_x.

With this accounting, the net NO_x PSD change for Solvay additions to the plant from all applicable permits is shown in Table G. As can be seen the "contemporaneous decreases in actual emissions" completely offset the increases in PSD increment consuming sources proposed at the Solvay Plant, resulting in a net emissions decrease of 126.52 TPY for PSD purposes on this "D" Train expansion project.

Table G: Solvay PSD Net Emissions Changes (Nitrogen Oxides TPY)

Source	Average Actual Emissions		Permitted Emission		Net Change	
	2 Year Avg	Record Year	Existing	Modified	Permitted	Actual
Contemporaneous Decreases						
AQD #17 gas conversion	684.49	'93-94	1314.00	87.60	-1226.40	-596.89
Total Decreases	684.49	n.a.	1314.00	87.60	-1226.40	-596.89
PSD Increases						
AQD #17 TPH/burner adj	66.18	'95-96	87.60	131.40	43.80	65.22
AQD #48 TPH/burner adj	31.31	'95-96	43.80	65.70	21.90	34.39
"D" Train Expansion	n.a.	n.a.	0.00	235.64	235.64	235.64
Total Increases	97.49	n.a.	131.40	432.74	301.34	335.25
Subtotal, Increment Consuming Emissions This Project					-925.06	-261.64
Total Increment Consuming Emissions Considered in Last Analysis (current)						135.12
Subtotal Solvay Increment Consuming Emissions						-126.52
Subtract Emissions Considered in Previous Increment Analysis						0.00
Net Nitrogen Oxides Emissions Change (since last PSD Analysis)						-126.52

As can be seen, there were 135.12 TPY of NO_x emission consuming emissions at the plant previously, therefore with the current reduction, the total PSD NO_x consuming emissions at Solvay now total to -126.52 TPY. These emission represent the total PSD NO_x increment consumption at the Solvay plant to date.

Section 24(a)(xii)(C) of the Wyoming Air Quality Standards & Regulations, limits the use of a "contemporaneous net emission decrease" to only one application. Therefore the "excess" NO_x credit of -126.52 TPY NO_x, cannot be used again in future application to offset any other projects which have NO_x increases

♦ PSD VOC Accounting ♦

Permit changes occurring after the 1977 effective date of the PSD regulations at the Solvay plant include the following permits and waivers:

Permit Number	Date Issued	Project Description
CT-234	Jul '79	initial construction of a 1 MM TPY soda ash plant
CT-234A	Dec '81	AQD #16 stack parameter modifications
CT-234A2 (OP-154)	Sep '84	address as-built modifications to 1 MM TPY plant
CT-643	Sep '85	initial design for construction of the Alkaten plant
CT-643A (OP-181)	Jul '86	revised plans for construction of the Alkaten plant
MD-117 (OP-257)	Feb '90	caustic/sodium sulfite facility & DR-4 fluid bed drier
MD-132 (OP-258)	Nov '90	"C" soda ash product line → 2 MM TPY plant capacity
T-200 Waiver	Feb '92	construct T-200 Alkaten storage bin & AQD #54 baghouse
CT-946	Mar '92	calcined trona project (project was mostly abandoned)
MD-229	Jun '95	conversion of "A" & "B" trona calciners to gas firing
MD-282	May '96	construction of a meta-bisulfite production facility

Because this plant was not constructed until 1982, after the 1977 effective date of the PSD regulations, all of the emissions from the facility consume PSD increment.

The MD-282 permit analysis provides an update of the PSD status for the Solvay Green River plant, showing the list of sources that were in place after that project. Although VOC emission totals were not shown in that analysis, a review based on currently defined VOC emission rates of that source list shows that there were 4639.30 TPY of VOC emissions permitted from the plant. VOC emissions had not been considered in the past PSD increment consumption analyses, therefore at that time, all plant emissions count toward the "net emissions increase" calculation for PSD VOC increment consumption at the Solvay plant.

As noted, under this project Solvay is proposing to retire ore reclaim baghouse AQD #2b and sulfite product bagging baghouse AQD #40 from service; and will also abandon plans for the MD-282 permitted AQD #69 soda ash bagging silo bin vent. These emission sources have no VOC emissions, therefore there is no credit due for their elimination.

As noted previously, under this permit Solvay intends to increase the trona ore throughput on the calciners exhausting to AQD #17 and AQD #48 stacks. VOC emissions are a function of throughput, figured at 1.94 pounds per ton of throughput on these two stacks. Thus AQD #17 will increase VOC emissions by 147.44 pph (162 TPH ore throughput, increased to 200 TPH on both "A" & "B" calciner), while AQD #48 will increase VOC emissions by 73.72 pph (162 TPH ore throughput, increased to 200 TPH on "C" calciner), for a total increase of 221.16 pph, or 968.68 TPY. Actual emissions for the two sources for the past two years are 2,678.61 TPY for AQD #17 (628.56 pph @ 8523 average hours operation 1995-1996), and 1,274.56 TPY for AQD #48 (314.28 pph @ 8111 average hours operation 1995-1996).

New equipment installed under this permit adds a total of 2,239.10 TPY of VOC.

With this accounting, the net VOC PSD change for Solvay additions to the plant from all applicable permits is shown in Table H. As can be seen there is no "contemporaneous decreases in actual emissions" to offset the increases in PSD increment consuming sources proposed at the Solvay Plant, resulting in a net emissions increase of 8123.55 TPY for PSD purposes on this "D" Train expansion project.

Table H: Solvay PSD Net Emissions Changes (Volatile Organic Compounds TPY)						
	Average Actual Emissions		Permitted Emission		Net Change	
Source	2 Year Avg	Record Year	Existing	Modified	Permitted	Actual
Contemporaneous Decreases						
no available decreases	0.00	n.a.	0.00	0.00	0.00	0.00
Total Decreases	0.00	n.a.	0.00	0.00	0.00	0.00
PSD Increases						
AQD #17 → 400 TPH	2678.61	'95-96	2753.09	3398.88	645.79	720.27
AQD #48 → 200 TPH	1274.56	'95-96	1376.55	1699.44	322.89	424.88
"D" Train Expansion	n.a.	n.a.	0.00	2339.10	2339.10	2339.10
Total Increases	3953.17	n.a.	4129.64	7437.42	3307.78	3484.25
Subtotal, Increment Consuming Emissions This Project					3307.78	3484.25
Total Increment Consuming Emissions Considered in Last Analysis (current)						4639.30
Subtotal Solvay Increment Consuming Emissions						8123.55
Subtract Emissions Considered in Previous Increment Analysis						0.00
Net Volatile Organic Compound Emissions Change (since last PSD Analysis)						8123.55

As can be seen, there were 4639.30 TPY of VOC emission consuming emissions at the plant previously, therefore for the purpose of calculating the "net emissions increase" for this project, PSD VOC emissions at Solvay are now 8123.55 TPY for comparison against the Section 24(a)(xxi)(A) significance threshold. The current 7947.10 TPY plant VOC emission total represents the full applicable PSD VOC emission consumption at the Solvay plant to date.

♦ PSD CO Accounting ♦

Permit changes occurring after the 1977 effective date of the PSD regulations at the Solvay plant include the following permits and waivers:

Permit Number	Date Issued	Project Description
CT-234	Jul '79	initial construction of a 1 MM TPY soda ash plant
CT-234A	Dec '81	AQD #16 stack parameter modifications
CT-234A2 (OP-154)	Sep '84	address as-built modifications to 1 MM TPY plant
CT-643	Sep '85	initial design for construction of the Alkaten plant
CT-643A (OP-181)	Jul '86	revised plans for construction of the Alkaten plant
MD-117 (OP-257)	Feb '90	caustic/sodium sulfite facility & DR-4 fluid bed drier

MD-132 (OP-258)	Nov '90	"C" soda ash product line → 2 MM TPY plant capacity
T-200 Waiver	Feb '92	construct T-200 Alkaten storage bin & AQD #54 baghouse
CT-946	Mar '92	calcined trona project (project was mostly abandoned)
MD-229	Jun '95	conversion of "A" & "B" trona calciners to gas firing
MD-282	May '96	construction of a meta-bisulfite production facility

Because this plant was not constructed until 1982, after the 1977 effective date of the PSD regulations, all of the emissions from the facility consume PSD increment.

The MD-282 permit analysis provides an update of the PSD status for the Solvay Green River plant, showing the list of sources that were in place after that project. Although CO emission totals were not shown in that analysis, a review based on currently defined CO emission rates of that source list shows that there were 1896.69 TPY of CO emissions permitted from the plant. CO emissions had not been considered in the past PSD increment consumption analyses, therefore at that time, all plant emissions count toward the "net emissions increase" calculation for PSD CO increment consumption at the Solvay plant.

As noted, under this project Solvay is proposing to retire ore reclaim baghouse AQD #2b and sulfite product bagging baghouse AQD #40 from service; and will also abandon plans for the MD-282 permitted AQD #69 soda ash bagging silo bin vent. These emission sources have no CO emissions, therefore there is no credit due for their elimination.

As noted previously, under this permit Solvay intends to increase the trona ore throughput and on the calciners exhausting to AQD #17 and AQD #48 stacks. CO emissions are a function of throughput, figured at 3.81 pounds per ton of throughput on these two stacks. Thus AQD #17 will increase CO emissions by 289.56 pph (162 TPH ore throughput, increased to 200 TPH on both "A" & "B" calciner), while AQD #48 will increase CO emissions by 144.78 pph (162 TPH ore throughput, increased to 200 TPH on "C" calciner), for a total increase of 434.34 pph, or 1902.41 TPY. Actual emissions for the two sources for the past two years are 5,260.57 TPY for AQD #17 (1,234.44 pph @ 8523 average hours operation 1995-1996), and 2,503.14 TPY for AQD #48 (617.22 pph @ 8111 average hours operation 1995-1996).

New equipment installed under this permit adds a total of 4,689.89 TPY of CO.

With this accounting, the net CO PSD change for Solvay additions to the plant from all applicable permits is shown in Table J. As can be seen there is no "contemporaneous decreases in actual emissions" to offset the increases in PSD increment consuming sources proposed at the Solvay Plant, resulting in a net emissions increase of 15,229.6 TPY for PSD purposes on this "D" Train expansion project.

Table J: Solvay PSD Net Emissions Changes (Carbon Monoxide TPY)						
Source	Average Actual Emissions		Permitted Emission		Net Change	
	2 Year Avg	Record Year	Existing	Modified	Permitted	Actual
Contemporaneous Decreases						
no available decreases	0.00	n.a.	0.00	0.00	0.00	0.00
Total Decreases	0.00	n.a.	0.00	0.00	0.00	0.00
PSD Increases						
AQD #17 ➔ 400 TPH	5260.57	'95-96	5406.85	6675.12	1268.27	1414.55
AQD #48 ➔ 200 TPH	2503.14	'95-96	2703.42	3337.56	634.14	834.42
"D" Train Expansion	n.a.	n.a.	0.00	4689.89	4689.89	4689.89
Total Increases	7763.71	n.a.	8110.27	14702.57	6592.30	6938.86
Subtotal, Increment Consuming Emissions This Project					6592.30	6938.86
Total Increment Consuming Emissions Considered in Last Analysis (current)						8290.81
Total Solvay Increment Consuming Emissions						15229.67
Subtract Emissions Considered in Previous Increment Analysis						0.00
Net Particulate Emissions Change (since last PSD Analysis)						15229.67

As can be seen, there were 8,290.81 TPY of CO emission consuming emissions at the plant previously, therefore for the purpose of calculating the "net emissions increase" for this project, PSD CO emissions at Solvay are now 15,229.67 TPY for comparison against the Section 24(a)(xxi)(A) significance threshold. The current 14,883.11 TPY plant CO emission total represents the full applicable PSD CO emission consumption at the Solvay plant to date.

♦ PSD Summary ♦

The following table shows the projected emission changes for the new Unit 6 plant equipment as compared with the "significance levels" contained in Section 24 (a)(xxi)(A) of the Wyoming Air Quality Standards & Regulations.

Table of Significance for PSD Applicability
Solvay "D" Train Plant Emissions (TPY)

Pollutant	Projected Emission Increase	Significant Emission Rate	Significant?
TSP	31	25	Yes
PM_{10}	31	15	Yes
NO_x	-127	40	No
VOC	3308	40	Yes
CO	6592	100	Yes

As can be seen, the "D" Train plant expansion project will not result in a significant net emissions increase for nitrogen oxides, but the project is significant for particulate, carbon monoxide and volatile organic compounds. Therefore this is not a "major modification" of a major emitting facility for NO_x, and increment consumption analysis is not required.

PROJECTED IMPACT ON EXISTING AMBIENT AIR QUALITY:

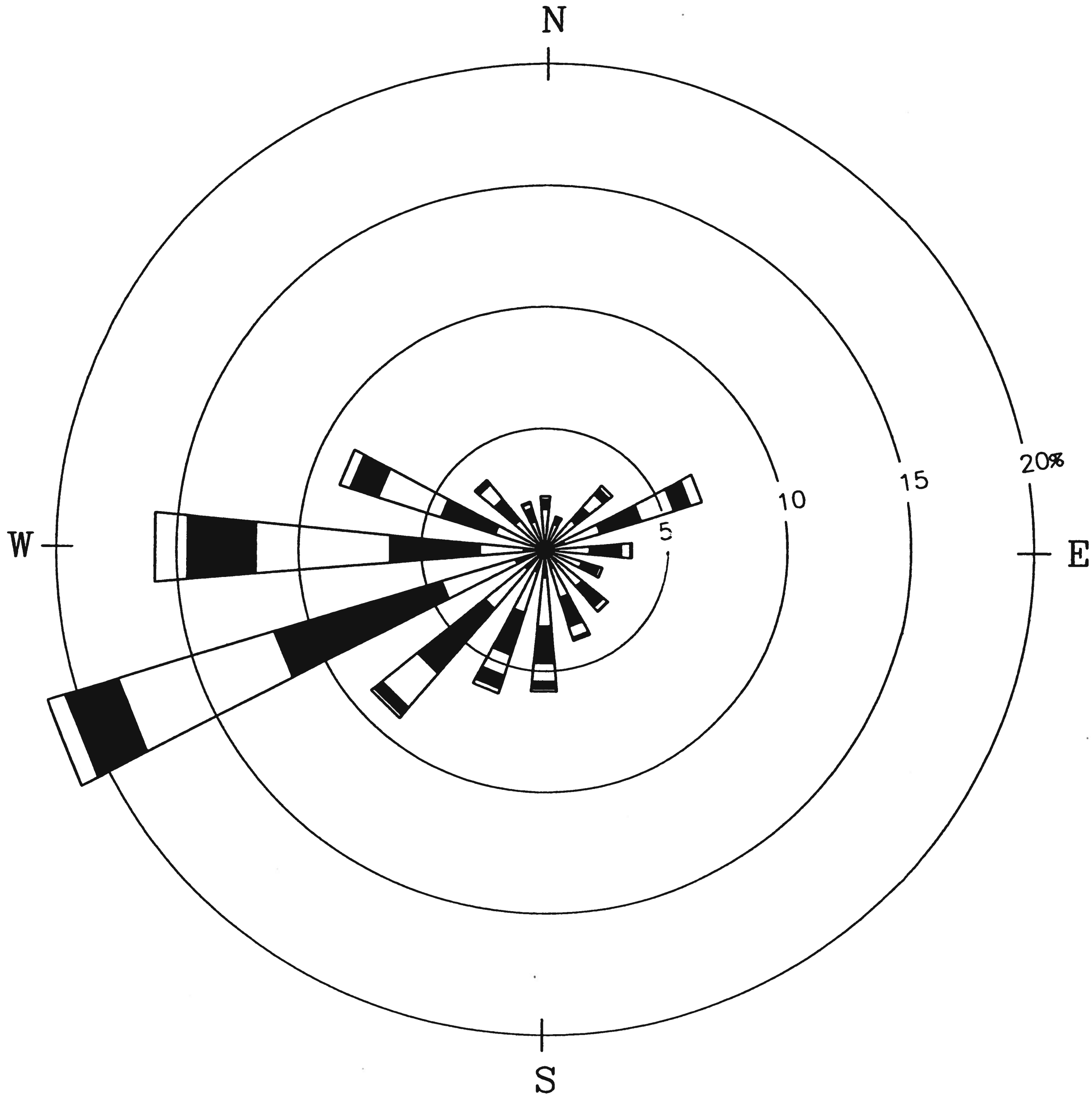
Model Justification: The applicant used the Industrial Source Complex 3 Short Term 3 (ISCST3) model, version 96113 for evaluating concentrations of PM_{10}, NO_x, CO and SO_2. The models were run with recommended regulatory defaults. Options used were rural dispersion coefficients with no exponential decay, final plume rise, stack tip downwash, buoyancy-induced dispersion, and calms processing. In addition, the applicant used Trinity Consultant's version of EPA's Building Profile Input Program to determine downwash parameters to include in the model runs. Terrain at or near the Solvay facility is slightly rolling with some terrain exceeding stack top elevation, and can be characterized as complex terrain. EPA has specified that the model of choice for complex terrain in an industrial setting with multiple sources is ISC3.

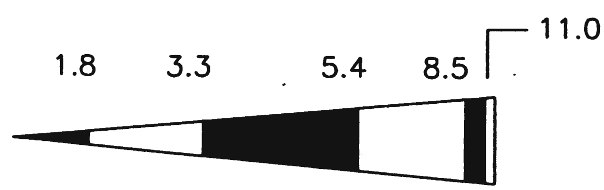
Meteorological Data: All modeling was performed using five (5) years of National Weather Service hourly surface meteorological data collected at the Rock Springs airport (Station #24027) for the calender years of 1987 to 1991. Twice-daily upper air soundings collected at the Lander airport (Station #24021) were processed for the same time period and merged with the hourly data. A wind rose which represents an average of the surface wind patterns during 1984, 1985, 1987, 1988 and 1989, is portrayed as a five year averaged joint frequency distribution and is shown in Figure 1. An average of the wind statistics for this data set indicates the predominant winds originate from the west-southwest direction approximately 21% of the time.

Background Concentrations: The NO_2 and CO background values are those used in Air Quality Permit CT-1148 for Wold Trona (1994). A background NO_2 concentration of 3.0 $\mu g/m^3$ was measured in 1983 at the Chevron Phosphate plant located 4.5 miles southeast of Rock Springs, Wyoming. Background concentrations for CO were obtained from monitored data collected by the Division and commercial operators (BLM, 1983). Ambient PM_{10} concentrations from Solvay's upwind PM_{10} monitor were evaluated for 1994-1996. The highest 24-hour average monitored PM_{10} value from 1995 was 57.0 $\mu g/m^3$, and the maximum annual averaged PM_{10} value from 1994 was 11.25 $\mu g/m^3$. All background concentrations are listed in Table 1.

Table 1. Background Concentrations Used in Solvay Minerals Analysis

Pollutant	Averaging Period	Background Concentration
NO_2	Annual	3.0 $\mu g/m^3$
CO	1-Hour	3,500 $\mu g/m^3$
CO	8-Hour	1,500 $\mu g/m^3$
PM_{10}	24-Hour	57.0 $\mu g/m^3$
PM_{10}	Annual	11.25 $\mu g/m^3$





WIND SPEED CLASS BOUNDARIES
(METERS/SECOND)

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE OF EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE – WIND IS BLOWING FROM THE NORTH 2.2 PERCENT OF THE TIME.

FIGURE 1
WINDROSE

RKSLND5Y.STR
NWS RKS/LND DATA SET
5YR JOINT FREQUENCY
ROCK SPRINGS AIRPORT
PERIOD: 1984-1989

BEE-LINE SOFTWARE

Emissions and Stack Parameters: Emission rates for the sources at Solvay Minerals are listed in Table 2a, and the corresponding stack parameters are listed in Table 2b. Changes in the design of the proposed expansion sources resulted in revisions to the original PM_{10} emission rates, and sources 47,74,75,77,78 and 84 were removed. Additionally, PM_{10} emission rates for four previously permitted sources (10, 11, 14 and 44) were also reduced; the allowable PM_{10} emission rates for these sources will be based on a 12 hour/day operating schedule. Allowable emission rates for all other sources were calculated based on an operational schedule of 8760 hrs/yr.

Receptor Grid: The NAAQS and PSD Class II modeling analyses were conducted using the receptor configuration shown in Figure 2. Receptor locations used in other analyses are described in the associated text. A 500-meter coarse receptor grid was generated using a 21x21 matrix; this grid encompassed an area approximately 3 kilometers in each direction of the Solvay facility. The southwest corner of the 500-meter coarse grid was located at UTM coordinate (599000,4590000).

A fine receptor grid was superimposed on the 500-meter grid to improve the resolution of all regions where maximum concentrations were identified in the coarse grid, and consists of an 36x31 matrix with 100-meter spacing. The southwest corner of the 100-meter fine grid was located at UTM coordinate (602000,4593500). Ninety-seven (97) discrete Cartesian receptors were also placed along the plant works boundary at 100-meter intervals.

The initial modeling indicated that maximum short-term (24-hour) impacts were occurring at a ridge approximately 700 meters southwest of the Solvay Minerals facility. Therefore, twenty-six (26) additional discrete Cartesian receptors were placed along this southwest ridge at 25-meter intervals for improved resolution in predicting 24-hour PM_{10} impacts.

Terrain elevations for each receptor were interpolated from electronic data contained in USGS 7.5 minute Digital Elevation Model (DEM) files compiled from four (4) quadrangle maps: Little America, Bryan, Massacre Hill, and Antelope Knoll NE. The consultant used Trinity's BREEZE AIR SUITE software to interpolate elevations for each receptor using an inverse-distance interpolation method to compute elevations from the known elevation values of the four neighboring DEM data points. Elevation contours which describe the surrounding topography used in the modeling domain are shown in Figure 2a, a 3-dimensional depiction of the local topography and the receptors used in the modeling analyses are shown in Figure 2b.

National Ambient Air Quality Standards (NAAQS) Analysis:

♦ Nitrogen Oxides (NO_x) ♦

The increase in NO_x emissions as a result of the proposed expansion is 235.6 TPY, and the total facility emissions are now 2671.4 TPY. The applicant modeled the total NO_x emissions from Solvay Minerals to determine compliance with the annual NAAQS of 100 $\mu g/m^3$. The maximum modeled annual NO_x concentration was 55.74 $\mu g/m^3$. Supplement C to the Guideline on Air Quality Models allows the use of the ambient ratio method, which provides for a 25% reduction in modeled NO_x concentrations for purposes of estimating nitrogen dioxide (NO_2) concentrations. Multiplying the maximum annual NO_x concentration by 0.75 yields an annual NO_2 concentration of 41.81 $\mu g/m^3$. The maximum predicted annual NO_2 concentration including the background value was 44.81 $\mu g/m^3$. The modeling analysis shows compliance with the NAAQS for NO_2 at the corrected emission levels. Results of the NAAQS modeling for NO_2 are shown in Table 3. An isopleth plot of the annual NO_x impact is shown in Figure 3.

Table 2a. Emission Rates Used in Modeling Analysis for Solvay Minerals

AQD#	Source ID	PM_{10} (g/s)	PM_{10} (lb/hr)	NOx (g/s)	NOx (lb/hr)	CO (g/s)	CO (lb/hr)	SO_2 (g/s)	SO_2 (lb/hr)	VOC (g/s)	VOC (lb/hr)
2A	Ore Crusher	0.20	1.60								
6A	Top Silos	0.04	0.30								
6B	Silo Reclaim	0.06	0.51								
7	Product Loadout	0.15	1.20								
10	Coal Crushing	0.03	0.26								
11	Coal Transfer	0.03	0.21								
14	Boiler Coal Bunker	0.05	0.37								
15	Product Dryer 1&2	0.55	4.34	0.15	1.20						
16	Product Classifier	0.11	0.90								
17	A&B Ore Calciners	2.81	22.30	3.78	30.00	192.02	1524.00			97.78	776.00
18	#1 Coal Boiler	0.63	5.00	30.87	245.00	2.21	17.50	8.82	70.00	0.06	0.50
19	#2 Coal Boiler	0.63	5.00	30.87	245.00	2.21	17.50	8.82	70.00	0.06	0.50
24	Boiler Flyash Silo	0.04	0.30								
25	Alkaten Crushing	0.13	1.00								
26	DR-3 Alkaten Dryer	0.07	0.55	0.03	0.25	0.01	0.07				
27	Alkaten Bagging	0.06	0.50								
28	DR-4 Product Dryer	0.37	2.90								
30	Lime Bin #1	0.03	0.20								
31	Lime Bin #2	0.03	0.20								
33	Sulfur Burner			0.19	1.50			0.05	0.40		
35	Sulfite Dryer	0.18	1.40								
36	Sulfite Bin #1	0.01	0.10								
37	Sulfite Bin #2	0.01	0.10								
38	Sulfite Bin #3	0.01	0.10								
39	Sulfite Bin #4	0.01	0.10								
41	Sulfite Loadout	0.02	0.19								
44	Lime Unloading	0.02	0.18								
45	Alkaten Transloading	0.03	0.20								
46	#2 Ore Transfer	0.09	0.71								
48	"C" Ore Calciner	1.17	9.30	1.89	15.00	96.01	762.00			48.89	388
50	"C" Train Dryer	0.09	0.70								
51	DR-5 Product Dryer	0.30	2.40	2.27	18.00	0.30	2.40				
52	Product Silo Top BH	0.06	0.50								
53	Product Silo Reclaim	0.06	0.45								
54	T-200 Silo	0.02	0.19								
55	Ore Recycle/Reclaim	0.05	0.40								
62	Carbon Bin Vent	0.02	0.13								
63	Perlite Bin Vent	0.02	0.17								
64	Sulfite Blending #2	0.01	0.08								
65	Sulfite Blending #1	0.00	0.03								
66	Carbon/Perlite Scrub	0.07	0.58								
67	Bottom Ash BH	0.06	0.47								
68	Trona Silo/Bagging	0.04	0.36								
70	Sulfite Silo/Bagging	0.03	0.27								
71	MBS Silo/Bagging	0.03	0.27								
72	MBS Soda Ash Feed	0.01	0.07								
73	MBS Product Dryer	0.11	0.90	0.02	0.15			0.10	0.77		
76	Primary Ore Screening	0.31	2.45								
79	Ore Transfer Point BH	0.11	0.84								
80	"D" Ore Calciner (#4)	1.54	12.25	2.52	20.00	132.05	1048.00			67.22	533.50
81	"D" Product Dryer	0.06	0.50								
82	DR-6 Product Dryer	0.43	3.45	3.78	30.00	1.76	14.00			0.03	0.27
83	Product Silo Top BH	0.05	0.41								
85	#3 Gas Fired Boiler	0.06	0.48	0.48	3.80	1.14	9.01	0.01	0.06	0.03	0.27

Regional PM_{10} Increment Consuming Sources

BC1	FMC -	0.38	3.00
BC2	FMC -	0.21	1.70
MONO11	FMC -	0.38	3.00
MONO12	FMC -	0.22	1.72
MW3	FMC -	0.03	0.27
RA29	FMC -	0.04	0.35
FD617	GEN CHEM -	0.03	0.23
GR3Q	GEN CHEM -	0.19	1.50

Table 2b. Stack parameters Used in Modeling Analysis for Solvay Minerals

AQD#	Source ID	Location UTM (E) (m)	UTM (N) (m)	Base Elevation (m)	Stack Height (m)	Stack Temp (°K)	Stack Velocity (m/s)	Stack Diameter (m)
2A	Ore Crusher	603,661	4,594,980	1,900	7.01	293.15	15.85	1.06
6A	Top Silos	603,893	4,594,835	1,903	40.54	309.00	24.99	0.64
6B	Silo Reclaim	603,900	4,594,811	1,903	4.72	297.00	10.06	0.67
7	Product Loadout	604,045	4,594,861	1,906	24.99	293.00	19.51	0.75
10	Coal Crushing	603,865	4,594,992	1,900	4.05	293.00	5.49	0.60
11	Coal Transfer	603,873	4,594,820	1,901	10.76	293.00	6.40	0.55
14	Boiler Coal Bunker	603,760	4,594,808	1,902	38.10	293.00	17.37	0.43
15	Product Dryer 1&2	603,719	4,594,814	1,902	54.86	347.00	14.94	1.83
16	Product Classifier	603,722	4,594,825	1,902	38.40	369.00	12.80	1.07
17	A&B Ore Calciners	603,686	4,594,808	1,902	55.02	464.00	13.41	3.66
18	#1 Coal Boiler	603,835	4,594,808	1,902	55.02	325.00	17.68	2.21
19	#2 Coal Boiler	603,835	4,594,780	1,902	55.02	322.00	18.29	2.21
24	Boiler Flyash Silo	603,820	4,594,786	1,902	7.62	301.50	12.50	0.30
25	Alkaten Crushing	603,666	4,595,012	1,900	23.16	293.00	14.63	0.73
26	DR-3 Alkaten Dryer	603,673	4,594,985	1,900	20.42	311.00	17.68	0.73
27	Alkaten Bagging	603,698	4,594,975	1,900	18.29	293.00	18.90	0.48
28	DR-4 Product Dryer	603,725	4,594,837	1,902	42.67	347.00	12.19	1.22
30	Lime Bin #1	603,939	4,594,768	1,902	26.82	293.00	17.98	0.20
31	Lime Bin #2	603,939	4,594,747	1,902	26.82	293.00	17.98	0.20
33	Sulfur Burner	603,892	4,594,725	1,905	30.48	339.00	10.67	0.61
35	Sulfite Dryer	603,929	4,594,725	1,905	31.39	327.00	14.63	0.70
36	Sulfite Bin #1	603,929	4,594,703	1,905	18.29	338.00	25.88	0.15
37	Sulfite Bin #2	603,943	4,594,703	1,905	18.29	338.00	25.88	0.15
38	Sulfite Bin #3	603,960	4,594,703	1,905	18.29	338.00	25.88	0.15
39	Sulfite Bin #4	603,974	4,594,703	1,905	18.29	338.00	25.88	0.15
41	Sulfite Loadout	603,987	4,594,724	1,905	21.34	338.00	21.34	0.30
44	Lime Unloading	603,987	4,594,748	1,905	19.20	293.00	17.07	0.30
45	Alkaten Transloading	604,030	4,594,847	1,906	5.43	293.00	8.84	0.27
46	#2 Ore Transfer	603,765	4,594,983	1,900	3.81	293.00	14.02	0.67
48	"C" Ore Calciner	603,686	4,594,846	1,902	54.86	450.00	9.75	3.20
50	"C" Train Dryer	603,713	4,594,847	1,902	54.86	366.00	8.23	1.37
51	DR-5 Product Dryer	603,739	4,594,838	1,902	54.86	422.00	10.06	2.44
52	Product Silo Top BH	603,899	4,594,884	1,903	42.98	293.00	15.24	0.46
53	Product Silo Reclaim	603,926	4,594,857	1,903	9.14	293.00	10.97	0.85
54	T-200 Silo	603,686	4,594,972	1,900	19.57	293.00	24.08	0.18
55	Ore Recycle/Reclaim	603,600	4,594,985	1,900	19.51	293.00	15.24	0.40
62	Carbon Bin Vent	603,640	4,594,741	1,900	27.74	293.00	25.91	0.15
63	Perlite Bin Vent	603,652	4,594,738	1,900	17.68	293.00	31.09	0.15
64	Sulfite Blending #2	603,974	4,594,690	1,905	4.57	293.00	29.26	0.15
65	Sulfite Blending #1	603,960	4,594,690	1,905	10.67	293.00	4.57	0.23
66	Carbon/Perlite Scrub	603,705	4,594,771	1,902	38.10	293.00	22.86	0.30
67	Bottom Ash BH	603,629	4,594,802	1,902	38.10	311.00	10.06	0.46
68	Trona Silo/Bagging	603,929	4,594,835	1,905	24.99	293.00	23.47	0.37
70	Sulfite Silo/Bagging	603,929	4,594,846	1,905	24.99	293.00	14.94	0.40
71	MBS Silo/Bagging	603,945	4,594,846	1,905	24.99	293.00	14.94	0.40
72	MBS Soda Ash Feed	603,897	4,594,715	1,905	18.49	366.00	16.15	0.20
73	MBS Product Dryer	603,885	4,594,715	1,905	28.96	305.00	17.07	0.61
76	Primary Ore Screening	603,587	4,594,993	1,900	33.53	288.71	17.22	1.12
79	Ore Transfer Point BH	603,486	4,594,996	1,900	18.29	288.71	18.26	0.63
80	"D" Ore Calciner (#4)	603,655	4,594,878	1,902	54.86	424.82	15.49	3.20
81	"D" Product Dryer	603,766	4,594,835	1,902	54.86	394.26	23.29	0.51
82	DR-6 Product Dryer	603,782	4,594,832	1,902	54.86	420.93	13.15	2.44
83	Product Silo Top BH	603,954	4,594,882	1,903	39.62	366.48	17.47	0.51
85	#3 Gas Fired Boiler	603,684	4,594,823	1,902	42.67	436.00	15.24	0.91

Regional PM_{10} Increment Consuming Sources

BC1	FMC -	599,153	4,608,435	1,896	28.35	350.37	18.63	0.76
BC2	FMC -	599,153	4,608,484	1,896	27.74	312.59	10.35	0.76
MONO11	FMC -	599,323	4,607,941	1,896	7.62	290.93	20.70	0.76
MONO12	FMC -	599,331	4,608,374	1,896	18.29	293.71	17.25	0.91
MW3	FMC -	599,058	4,608,059	1,896	39.62	338.71	18.38	1.98
RA29	FMC -	598,812	4,608,511	1,896	24.38	355.37	29.51	1.22
FD617	GEN CHEM -	603,742	4,605,237	1,902	[illegible]	[illegible]	[illegible]	[illegible]
GR3Q	GEN CHEM -	603,476	4,605,127	1,902	35.96	341.48	13.44	0.91

FIGURE 2

RECEPTOR LOCATIONS - SOLVAY MINERALS MODELING ANALYSIS

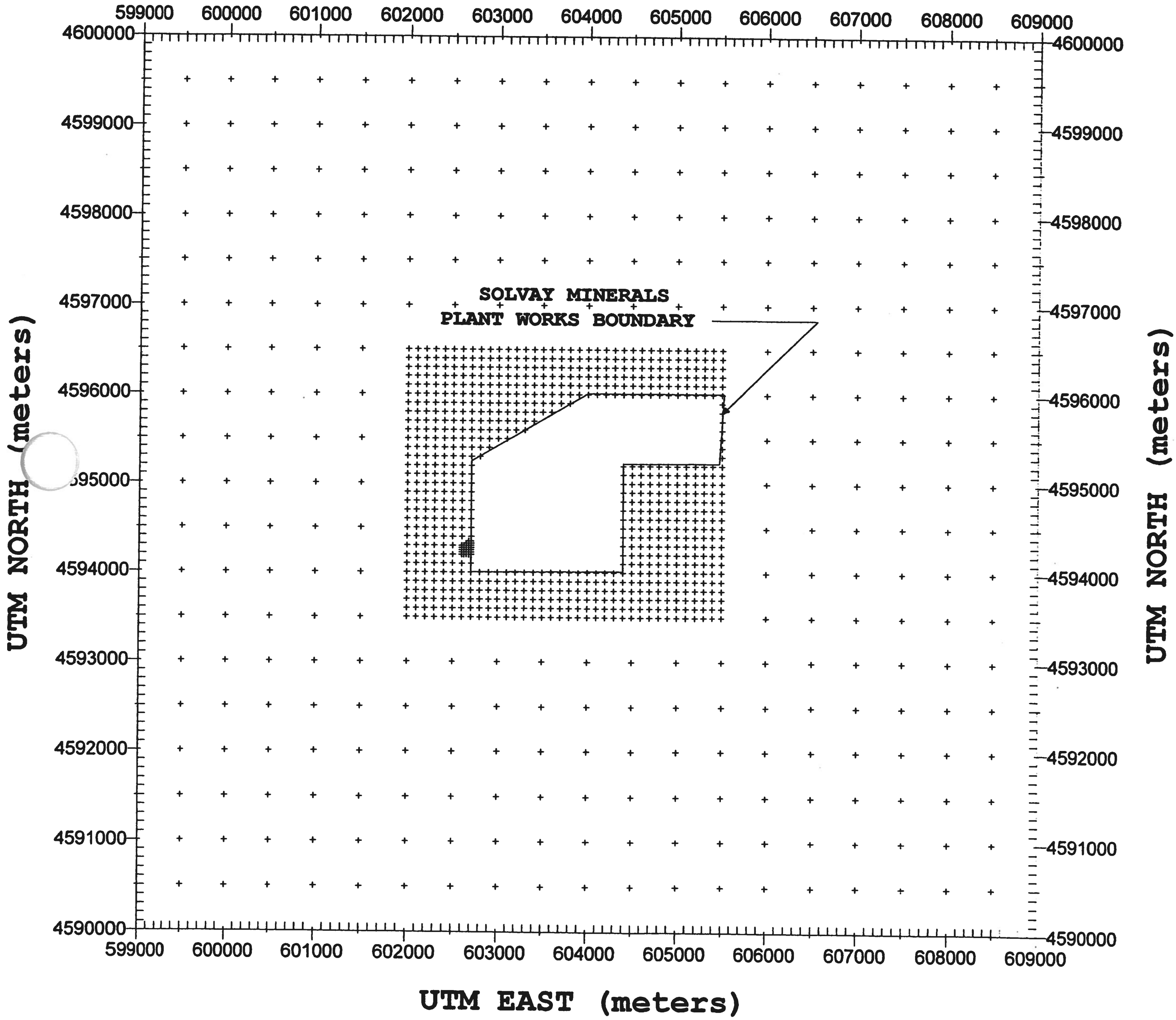
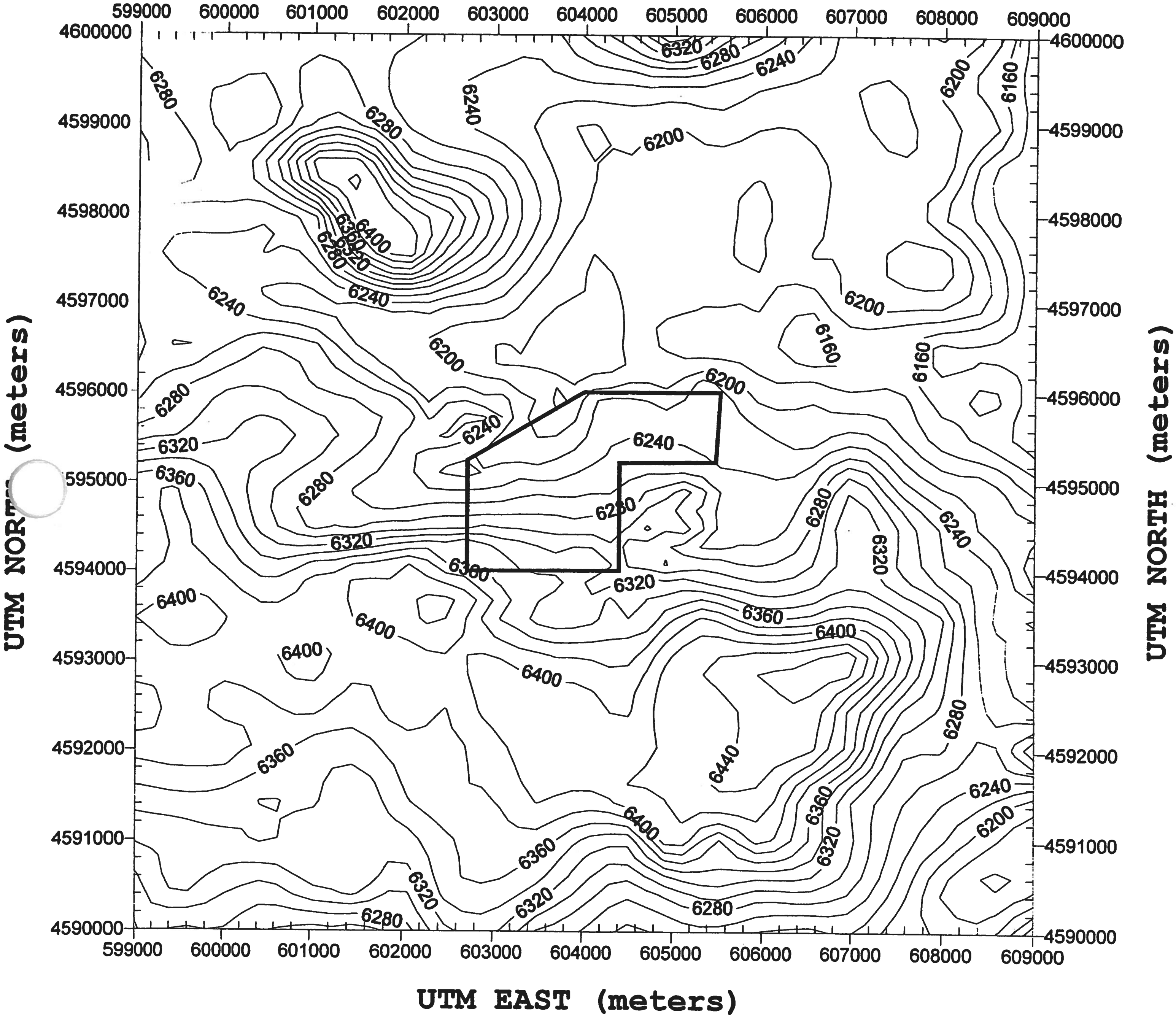


FIGURE 2a

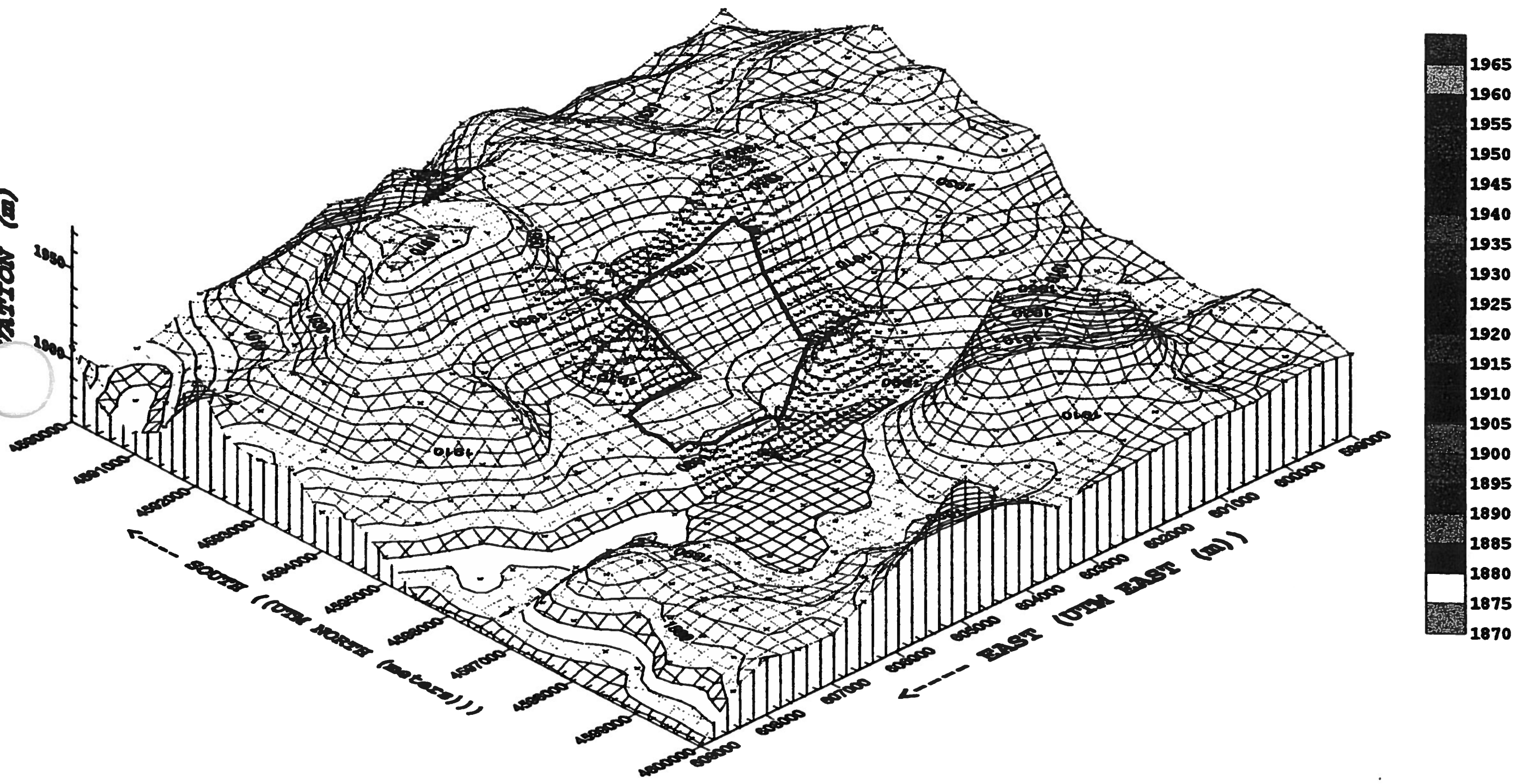
ELEVATION CONTOURS OF TOPOGRAPHY NEAR SOLVAY MINERALS



Elevations Measured in Feet

Contour Interval = 20 Feet

Figure 2b. Topography Represented in Modeling Analysis for Solvay Soda Ash



SOLVAY2016_1.4_001237

FIGURE 3

ANNUAL NOx CONCENTRATIONS (ug/m3)

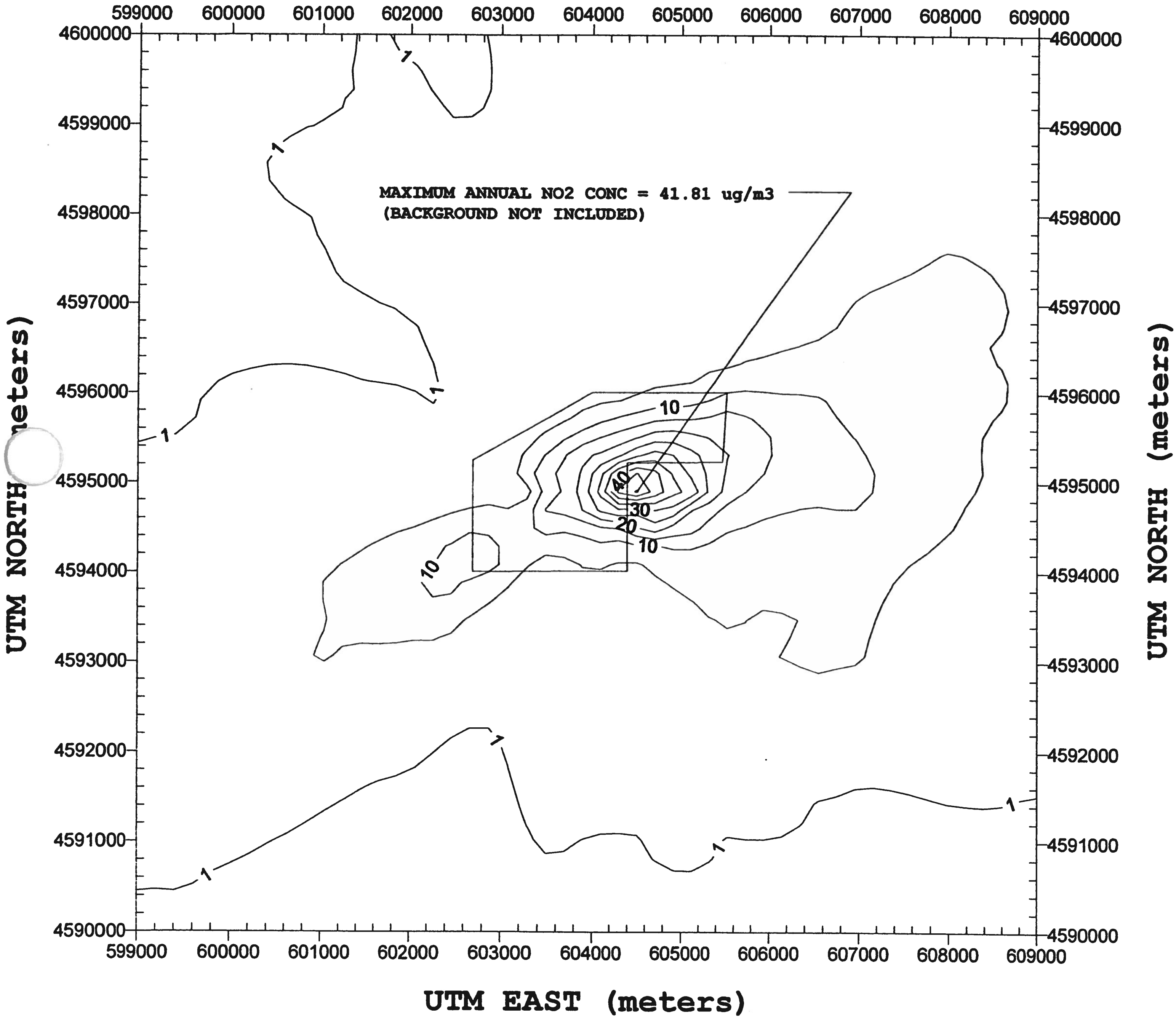


Table 3. Modeling Results for NAAQS Analysis using Ambient Ratio Method

Modeled Year	UTM Receptor Location X (m)	Y (m)	Maximum Annual NO_2 Conc. ($\mu g/m^3$)	Background Annual NO_2 Conc. ($\mu g/m^3$)	Total Annual NO_2 Conc. ($\mu g/m^3$)	Annual NO_2 NAAQS ($\mu g/m^3$)	Percent of Standard
1988	604400	4594900	41.81	3.0	44.81	100	44.8%

♦ **Carbon Monoxide (CO)** ♦

The applicant modeled CO emissions from the existing and proposed new sources at the Solvay facility to determine compliance with the 1-hour and 8-hour NAAQS of 40,000 $\mu g/m^3$ and 10,000 $\mu g/m^3$, respectively. The modeled impact from all sources based on the highest second highest (HSH) 1-hour and 8-hour concentrations of CO were 4,133 $\mu g/m^3$ and 1,148 $\mu g/m^3$, respectively, and occurred during the 1988 meteorological data year. The background values for CO provide a conservative estimate based on the conclusion that Solvay's contribution is already included in the background values. The 1-hour and 8-hour model predicted impacts including background concentrations were 7,633 $\mu g/m^3$ and 2,648 $\mu g/m^3$, respectively, which are well below the applicable NAAQS. Based on the results of this analysis, the Division is satisfied that the NAAQS for CO will be protected.

♦ **Particulate Matter under 10 Microns (PM_{10})** ♦

The applicant modeled PM_{10} emissions from all sources at Solvay to determine compliance with the 24-hour and annual PM_{10} NAAQS of 150 $\mu g/m^3$ and 50 $\mu g/m^3$, respectively. The highest second highest (HSH) modeled 24-hour PM_{10} concentration was 28.81 $\mu g/m^3$. Solvay choose to use the maximum monitored 24-hour PM_{10} value of 57.0 $\mu g/m^3$ rather than the second highest monitored value of 34.0 $\mu g/m^3$ to conservatively estimate the impacts from regional PM_{10} sources. Therefore, the HSH 24-hour modeled PM_{10} impact including the background value was 85.81 $\mu g/m^3$. The maximum modeled annual PM_{10} concentration was 8.94 $\mu g/m^3$; the predicted concentration including an 11.25 $\mu g/m^3$ background value was 20.19 $\mu g/m^3$. The modeled values show compliance with the applicable NAAQS for PM_{10}; results of the NAAQS modeling for PM_{10} are presented in Table 4 and Table 5. Isopleth plots of the 24-hour and annual PM_{10} impacts are presented in Figure 4 and Figure 5, respectively.

Table 4. Highest Second High 24-Hour PM_{10} Modeling Results for NAAQS Analysis

Modeled Year	Receptor Location X (m)	Y (m)	2nd High 24-Hour PM_{10} Conc. ($\mu g/m^3$)	Background 24-Hour PM_{10} Conc. ($\mu g/m^3$)	Total 24-Hour PM_{10} Conc. ($\mu g/m^3$)	24-Hour PM_{10} NAAQS ($\mu g/m^3$)	Percent of Standard
1989	602700	4594250	28.81	57.0	85.81	150	57.2%

Table 5. Annual PM_{10} Modeling Results for NAAQS Analysis

Modeled Year	Receptor Location X (m)	Y (m)	Maximum Annual PM_{10} Conc. ($\mu g/m^3$)	Background Annual PM_{10} Conc. ($\mu g/m^3$)	Total Annual PM_{10} Conc. ($\mu g/m^3$)	Annual PM_{10} NAAQS ($\mu g/m^3$)	Percent of Standard
1988	604400	4594900	8.94	11.25	20.19	50	40.4%

FIGURE 4

HIGHEST SECOND HIGH 24-HR PM10 CONC (ug/m3)

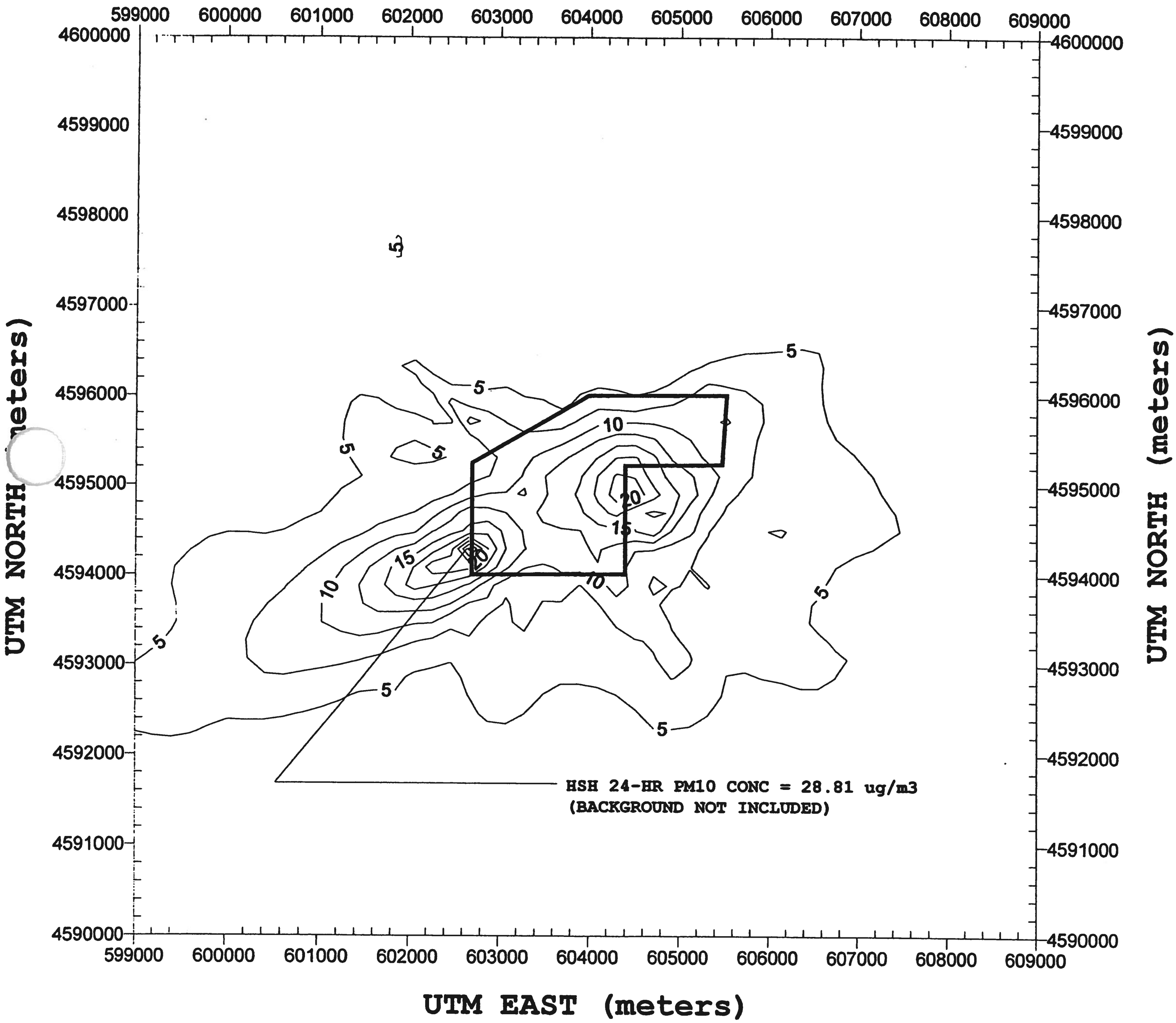
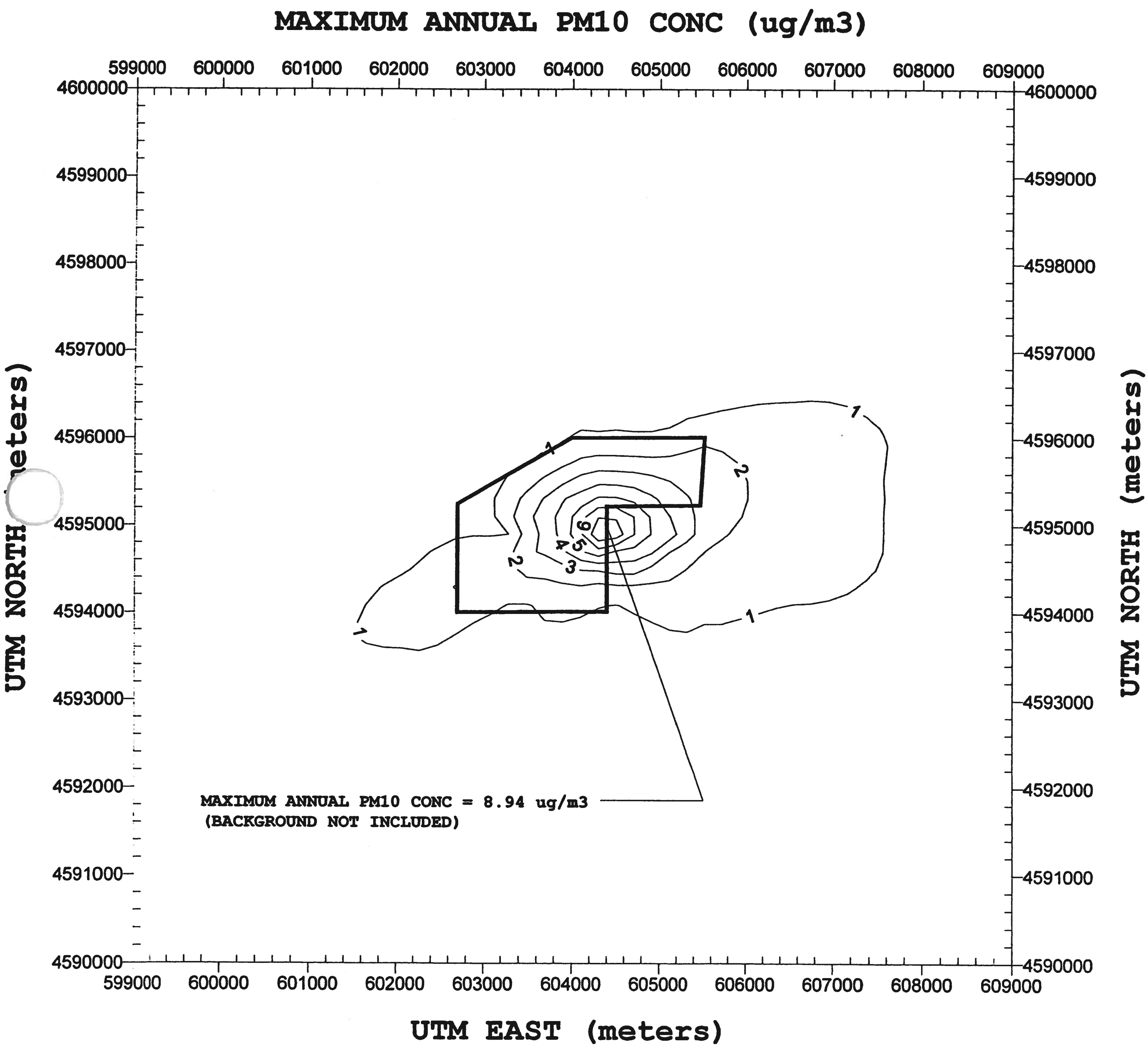


FIGURE 5


MAXIMUM ANNUAL PM10 CONC (ug/m3)
599000
600000
601000
602000
603000
604000
605000
606000
607000
608000
609000
4600000
4599000
4598000
4597000
4596000
4595000
4594000
4593000
4592000
4591000
4590000
UTM NORTH (meters)
UTM EAST (meters)
1
2
3
4
5
6
MAXIMUM ANNUAL PM10 CONC = 8.94 ug/m3
(BACKGROUND NOT INCLUDED)

The 1996 PM_{10} monitoring data from the four downwind trona production facilities reveals that the ambient air quality in this region was in compliance with all applicable PM_{10} ambient standards during the calender year of 1996. Based on the compliance monitoring in this region and the results of this analysis, the Division is satisfied that the proposed increase in allowable PM_{10} emissions, and the existing PM_{10} sources at Solvay Minerals facility will not contribute to any significant impacts at the other trona production facilities.

♦ Sulfur Dioxide (SO_2) ♦

The applicant modeled SO_2 emissions from this facility to determine compliance with the 3-hour, 24-hour and annual Wyoming Ambient Air Quality Standards of 1300, 260, and 60 $\mu g/m^3$, respectively. The HSH modeled 3-hour and 24-hour ambient SO_2 concentrations were 446.21 $\mu g/m^3$ and 79.00 $\mu g/m^3$, respectively; the maximum modeled annual SO_2 concentration was 15.11 $\mu g/m^3$. The results of this analysis indicate that model predicted concentrations of SO_2 from this facility are well below the applicable NAAQS. Based on the results of this analysis, the Division is satisfied that the NAAQS for SO_2 will be protected.

Hazardous Air Pollutants (HAPs) Analysis: The applicant submitted a modeling analysis for HAPs based on average tested HAP emission rates from the three existing Calciners. Testing was conducted during November 1996, using a gas chromatograph/mass spectrometer to provide an accurate identification of the speciated VOCs; the test results are provided in the permit application in Tables 3-2, 3-3, 3-4 and 3-5. The average tested emission rate for each HAP is shown along with a corresponding maximum emission rate which was derived to include three standard deviations. The A and B Calciners (AQD #17) were tested at the combined production rate of 400 tons per hour (TPH) and Calciner C (AQD #48) was tested at 200 TPH. The HAP emission rates for the proposed "D" Calciner (AQD #80) were estimated based on the tested emission rates of the existing Calciners at their respective production rates, and the average of the ratioed values was used to reflect the proposed 275 TPH production rate of the "D" Calciner.

EPA Reference Methods 18 and 25A were used for determining VOC emission rates, and EPA Reference Methods 0010, 0011, and 0030 were used for determining HAP emission rates. EPA Reference Methods 0010, 0011, and 0030 are reference methods that were developed for analyzing volatile and semi-volatile organic compounds and are recognized by the Division as acceptable methods for analyzing HAPs in conjunction with EPA Reference Methods 18 and 25A.

An ambient air impact was completed for each of the twenty-seven (27) HAPs listed in Table II. The applicant's modeling analysis was completed using HAP emission rates based test data for the existing calciners, projected emission rates from the new calciner and the mine vent exhaust. EPA's ISCST3 model was used to assess short-term concentrations of each of the HAPs; the models were run using a 500-meter coarse receptor grid centered over the facility in a 21x21 matrix. The modeled concentrations predicted by this analysis are shown in Table III. The modeled HAP concentrations were compared to the lowest and highest listed Acceptable Ambient Level (AAL) for twenty-two (22) HAPs found in EPA's National Air Toxics Clearinghouse (NATICH) data base; this data base lists AALs for 1-hour, 8-hour, 24-hour, and annual averaging periods for various states in the United States. The HAPs which exceeded the minimum AALs on an annual basis were 1,3 butadiene, benzene, formaldehyde and acrylonitrile; modeled concentrations of 1,3 butadiene were also found to exceed the minimum AAL for the 1-hour and 24-hour averaging periods, and modeled concentrations of benzene and formaldehyde were also found to exceed the minimum AAL over a 24-hour averaging

Table III. Modeling Results for Solvay Soda Ash HAP Analysis

(1987 - 1991 Rock Springs Meteorological Data)

	5-Year Maximum Impacts (μgm/m^3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	0.48	0.15	0.077	0.0071
ACETONE	0.33	0.1019	0.057	0.0050
ACETOPHENONE	0.032	0.010	0.0052	0.00048
ACROLEIN	1.23	0.37	0.20	0.018
*ACRYLONITRILE	1.52	0.46	0.26	0.023
BENZENE	25.29	7.72	3.97	0.37
BIPHENYL	0.046	0.014	0.0073	0.00068
BIS(2-ETHYLHEXYL)PHTHALATE	0.0030	0.00092	0.0005	0.00004
1,3 BUTADIENE	18.55	5.66	2.88	0.27
2-BUTANONE	4.74	1.45	0.82	0.072
2-CHLOROACETOPHENONE	0.0030	0.00092	0.0005	0.00004
CUMENE	0.004	0.0011	0.0006	0.00005
DI-N-BUTYLPHTHALATE	0.023	0.0071	0.0037	0.00034
DIBENZOFURAN	0.039	0.012	0.0062	0.00058
ETHYL BENZENE	2.51	0.76	0.42	0.038
FORMALDEHYDE	0.34	0.11	0.059	0.0050
HEXANE	7.85	2.40	1.24	0.116
*METHYLENE CHLORIDE	1.10	0.33	0.16	0.016
3/4 METHYLPHENOL	0.019	0.0058	0.0031	0.00028
N,N-DIMETHYLANILINE	0.016	0.0049	0.0026	0.00024
NAPHTHALENE	0.30	0.09	0.048	0.0044
PHENOL	0.18	0.056	0.029	0.0027
PROPIONALDEHYDE	0.14	0.042	0.022	0.0021
STYRENE	4.59	1.40	0.72	0.068
TOLUENE	10.47	3.19	1.69	0.156
*1,1,1-TRICHLOROETHANE	8.85	2.70	1.31	0.129
*TRICHLOROETHENE	9.11	2.84	1.57	0.135
XYLENE	13.87	4.23	2.25	0.207

Table III a. NATICH Lowest Allowable Ambient HAP Levels

	Lowest AALs (µg/m3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	90	900	4.89	0.45
ACETOPHENONE	150	-	40	49
ACROLEIN	2.3	2.3	0.6	0.0004
ACRYLONITRILE	21	21.5	1.18	0.0147
BENZENE	30	30	1.74	0.1
BIPHENYL	2.3	13	0.34	0.01
BIS(2-ETHYLHEXYL)PHTHALATE	50	50	4	0.2
1,3 BUTADIENE	7.2	220	1.2	0.003
2-BUTANONE	3900	5900	32.1	32.1
CUMENE	500	2450	588	0.009
ETHYL BEN[illegible]	2000	4340	118	118
FORMALD[illegible]	[illegible]	[illegible]	0.033	0.004
HEX[illegible]	[illegible]	[illegible]	432	176
ME[illegible]E	[illegible]	870	9.45	0.2
[illegible]E	[illegible]	500	120	14
[illegible]	[illegible]	95	45.6	10
PROPIONALDEHYDE	21	4290	-	-
STYRENE	215	1070	116	1.75
TOLUENE	1880	1870	10.2	10.2
1,1,1-TRICHLOROETHANE	10800	4550	1040	1000
TRICHLOROETHENE	1100	1350	36.5	0.42
XYLENE	2079	2170	3500	434

Table III b. NATICH Highest Allowable Ambient HAP Levels

	Highest AALs (µg/m3)			
	1-hour	8-hour	24-hour	Annual
ACETALDEHYDE	2700	4290	18000	600
ACETOPHENONE	490	-	4910	100
ACROLEIN	*80	6.9	6	0.83
ACRYLONITRILE	43	107	43	15
BENZENE	630	714	320	100
BIPHENYL	2.3	36	126	5
BIS(2-ETHYLHEXYL)PHTHALATE	100	119	200	120
1,3 BUTADIENE	110	52400	528	11
2-BUTANONE	*89000	11800	59000	1970
CUMENE	500	5860	24600	245
ETHYL BENZENE	*54000	43500	7200	5430
FORMALDEHYDE	*150	71	12	7.69
HEXANE	5300	36000	29000	200
METHYLENE CHLORIDE	17400	8330	8750	8440
NAPHTHALENE	*7900	1190	50000	167
PHENOL	950	1900	456	456
PROPIONALDEHYDE	21	4290	-	-
STYRENE	*42500	5120	21300	716
TOLUENE	*56000	8930	37700	7500
1,1,1-TRICHLOROETHANE	*250000	190000	191000	38000
TRICHLOROETHENE	10700	6430	134000	6840
XYLENE	6510	4400	7200	434

* 15-minute average

period. There were no occurrences where the maximum modeled concentration of any HAP was greater than the maximum AAL's for any averaging period.

A risk assessment was conducted for the HAPs which are suspected carcinogens. These HAPs include Acrylonitrile, Benzene, 1,3 Butadiene, Formaldehyde, Methylene Chloride, Trichloroethene, and Bis(2-Ethylhexyl)phthalate. A unit risk factor was obtained from the IRIS data base for each of the HAP's listed above. Calculated risk was determined by multiplying the maximum modeled annual concentration by the appropriate unit risk factor, and multiplying this value by one million to determine the risk of contracting cancer on the basis of 1 in a million. Results of the risk assessment are shown in Table IV.

The risk assessment indicated that 1,3 Butadiene and Benzene are the only HAPs which have a calculated risk of exposure to be greater than 1 in a million; the calculated risk for 1,3 Butadiene was 7.6E-05, or approximately 76 in a million. Summing the risk for all carcinogens emitted from this facility yields a total risk of 79.1E-06, or approximately 79 in a million, which indicates that 1,3 Butadiene is the greatest contributor, based on the applicant's analysis of average tested HAP emission rates.

The Wyoming Air Quality Standards and Regulations do not contain ambient standards for HAP's. The regulations do require that HAP emissions be addressed through analysis of BACT. The review of VOC controls, HAP's being a subset of the VOC emissions, in the BACT section of this analysis has addressed this issue. The applicant's analysis demonstrates that the majority of the modeled concentrations from this facility are below the most stringent AAL's used for comparison and none of the modeled concentrations exceed any of the maximum AAL's from other states based on the average tested HAP emission rates.

PSD Significant Impact Analysis:

♦ Nitrogen Oxides (NO_x) ♦

The increase in allowable NO_x emissions due to this modification is 235 TPY. However, the proposed increase has been offset by the summation of all actual decreases in NOx emissions since the last PSD permit for nitrogen oxides. Therefore, the net change in NO_x emissions from the proposed modification is below the PSD significant emission rate of 40 TPY, and a PSD analysis for NO_2 is not required.

♦ Particulate Matter (PM_{10}) ♦

The allowable PM_{10} emissions from Solvay Minerals including the net emissions increase from the proposed modification is 384.8 TPY. The net increase in particulate emissions due to this modification is 31.33 TPY, and is above the PSD significant emission rate of 15 TPY for PM_{10}. Therefore, a significant impact analysis is required under PSD regulations to determine the PM_{10} impacts from the proposed modification. These impacts are compared to PSD modeling significant impact levels (SIL's) for PM_{10} to determine if further impact analyses for this pollutant are required. Results of this analysis are presented below:

Source Group	Averaging Period	Modeled Conc.	PSD SIL's
Proposed PM_{10} IC	Annual	1.43 $\mu g/m^3$	1.0 $\mu g/m^3$
Sources @ Solvay	HSH 24-hour	10.7 $\mu g/m^3$	5.0 $\mu g/m^3$

The applicant also modeled the entire 384.8 TPY of PM_{10} to demonstrate that total PM_{10} impacts from Solvay Minerals are localized and do not show a significant impact at the other trona production facilities in this region. The results of this analysis

Table IV. Results of Solvay Soda Ash Air Toxics Risk Assessment

HAP Pollutant	Unit Risk Factor	Maximum Modeled Annual Concentration ($\mu g/m^3$)	Calculated Risk
*Acrylonitrile	6.8×10^{-6}	0.023	1.56×10^{-7}
Benzene	8.3×10^{-6}	0.37	3.07×10^{-6}
Bis(2-Ethylhexyl)phthalate	2.4×10^{-7}	0.00004	9.6×10^{-12}
1,3 Butadiene	2.8×10^{-4}	0.27	7.56×10^{-5}
Formaldehyde	1.3×10^{-5}	0.005	6.5×10^{-8}
*Methylene Chloride	4.1×10^{-6}	0.016	6.56×10^{-8}
*Trichloroethene	1.3×10^{-6}	0.135	1.76×10^{-7}

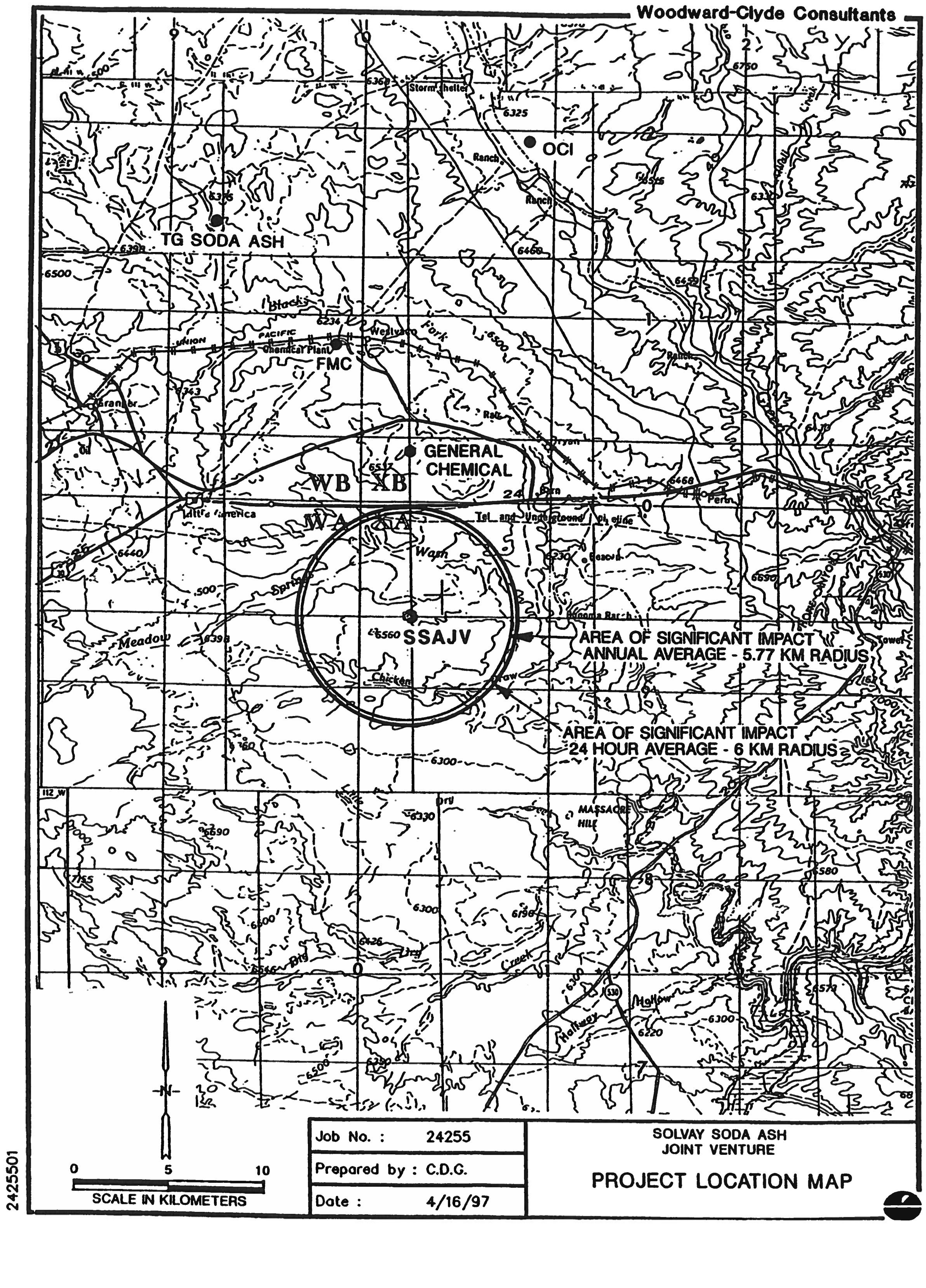


FIGURE 6. PM_{10} SIGNIFICANT IMPACT RADII - SOLVAY SODA ASH EXPANSION

show that the 1.0 $\mu g/m^3$ and the 5.0 $\mu g/m^3$ PM_{10} impacts from all existing and proposed sources occur within 2.0 kilometers of Solvay's plant works boundary. A plot which shows the PM_{10} significant impact radii for Solvay Minerals along with the location of the other trona production facilities is presented in Figure 6.

The Division modeled all PM_{10} sources at Solvay Minerals to assess PM_{10} impacts at General Chemical. A single discrete Cartesian receptor was located at the site of General Chemical's GR-3-X "E" boiler, which is located 10.2 kilometers (6.3 miles) northeast of Solvay Minerals; the UTM coordinate of the boiler is (616300,4605500). The maximum modeled annual PM_{10} concentration from Solvay Minerals at General Chemical was 0.15 $\mu g/m^3$, and the highest-second high model predicted 24-hr concentration was 1.50 $\mu g/m^3$. The results of this analysis indicate that PM_{10} impacts from the Solvay facility do not significantly impact the General Chemical facility, and will produce even less of an impact at any of the other more distant trona production facilities in this region.

The Division also modeled all PM_{10} sources at the General Chemical facility to assess PM_{10} impacts at the Solvay facility. The maximum model predicted annual PM_{10} concentration was 0.44 $\mu g/m^3$, and the highest-second highest model predicted 24-hr concentration was 6.00 $\mu g/m^3$ at UTM coordinate (604000,4594000), which is greater than the PM_{10} 24-hr significant impact level of 5.0 $\mu g/m^3$. Based on the results of the significant impact analysis, the applicant choose to model all increment consuming sources at the two (2) nearest trona production facilities: General Chemical and FMC.

PSD Class II Increment Consumption:

♦ Particulate Matter (PM_{10}) ♦

All sources at Solvay Minerals that emit particulate matter consume increment, as this facility was constructed after the major source baseline date for PM_{10}. A Class II PM_{10} increment consumption analysis was completed which included the increment consuming sources at General Chemical and FMC, and all existing and proposed PM_{10} sources at Solvay Minerals. The purpose of this analysis was to determine compliance with the 24-hour and annual PM_{10} PSD increments of 30 $\mu g/m^3$ and 17 $\mu g/m^3$, respectively.

The HSH modeled 24-hour PM_{10} cumulative impact was 28.81 $\mu g/m^3$, and the maximum annual cumulative PM_{10} impact was 8.94 $\mu g/m^3$; these impacts are identical, in space and in time, to the predicted impacts referenced in the NAAQS analysis for PM_{10}. Therefore, the Class II increment analysis indicates that the amount of PM_{10} increment consumed by General Chemical and FMC at or near Solvay Minerals is negligible for both averaging periods, and that all of the PM_{10} increments considered in this analysis are consumed by the sources at Solvay Minerals. This coincidence is largely due to the fact that General Chemical and FMC are located 10.2 kilometers and 14.2 kilometers, respectively, downwind of Solvay Minerals. Additionally, the majority of the sources of PM_{10} at General Chemical and FMC were constructed before the major source baseline for PM_{10}, and these two facilities therefore have fewer PM_{10} sources that consume increment. The amount of PM_{10} increment consuming emissions attributable to General Chemical and FMC amount to 10.0 lb/hr and 1.7 lb/hr, which are dominated by the 88.4 lb/hr of allowable PM_{10} increment consuming emissions modeled for Solvay Minerals.

PSD Class I Increment Consumption:

♦ **Particulate Matter (PM_{10})** ♦

The Division modeled all increment consuming sources of PM_{10} from Solvay Minerals, General Chemical, and FMC to determine the impacts at the Jim Bridger Wilderness Area, which is located approximately 141 kilometers (87.6 miles) northeast of Solvay Minerals. The receptor locations and elevations (meters) used in all Class I analyses are presented below:

CLASS I LOCATION	UTM (E)	UTM (N)	ELEV
Black Joe Lake	649685	4733290	3122
Deep Lake	649818	4731102	3201
Hobbs Lake	608370	4765547	3085
Ross Lake	608830	4804680	2948
Saddlebag Lake	664500	4720740	3432
Klondike Lake	611000	4787500	3418
Upper Titicomb Lake	610500	4775000	3230
Jim Bridger Boundary	650000	4717400	2454

Results of this analysis are presented below, and indicate that the modeled PM_{10} impacts from the proposed new sources at Solvay Minerals are below the allowable Class I increments. Additionally, the analysis shows that the cumulative impact from all increment consuming sources of PM_{10} from Solvay, General Chemical and FMC are also well below the Class I allowable increments.

Class I PM_{10} Increment Consumption Analysis for Jim Bridger Wilderness Area

Source Group	Averaging Period	Modeled Conc.	Class I Increment
Proposed PM_{10} IC Sources (Solvay)	Annual	0.0005 $\mu g/m^3$	4.0 $\mu g/m^3$
	HSH 24-hour	0.0047 $\mu g/m^3$	8.0 $\mu g/m^3$
All PM_{10} IC Sources	Annual	0.0028 $\mu g/m^3$	4.0 $\mu g/m^3$
	HSH 24-hour	0.0031 $\mu g/m^3$	8.0 $\mu g/m^3$

Air Quality Related Values:

Visibility: An evaluation of potential visibility impacts from all PM_{10} sources at Solvay Minerals was performed using the VISCREEN model, version 1.01. This analysis determines visibility impacts by comparing the plume perceptibility (ΔE) and plume contrast (C_P) to screening criteria values of $\Delta E = 2.0$ and $C_P = 0.05$.

The level 1 visibility screening indicated exceedances of the screening criterion for views inside the wilderness area for an observer positioned at the wilderness boundary. Therefore, a level 2 screening analysis was completed. The level 2 analysis is based on guidance in EPA's tutorial for the VISCREEN model, which recommends using five years of hourly meteorological data, and shifting the meteorological data stability classes to one level less stable (i.e, D → C) which accounts for the elevation change between the source and the Class I area. The Level

2 analysis showed compliance with the screening criteria for visual impacts inside the Class I area.

A visibility impairment analysis was also conducted to estimate the extinction coefficient (b_{ext}) resulting from the proposed increase in primary fine particulate emissions and condensible organic emissions. The relative change in visibility is a function of the ratio of the calculated source extinction coefficient and background extinction coefficient for the Class I Area. The methodology used to perform this evaluation was derived from Appendix B of the Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 1 Report: Interim Recommendation for Modeling Long Range Transport and Impacts on Regional Visibility.

As discussed earlier, VOC's have been found to be emitted from trona processing operations, and it is suspected that a majority of these VOC's are driven off from organic contaminants in the trona ore and possibly from the oil shale that is mined around the edges of the trona ore deposits. Therefore, the Division has incorporated the contribution of VOC condensible organics into this analysis to account for the visibility impacts from the formation of secondary organic aerosols. The rationale to include the condensible organics measured through testing is that if organics condense in the sampling train, then these organics have the potential to condense and form aerosols in the atmosphere.

Testing of Calciner CA-3 (AQD #48) was conducted at Solvay Minerals during the week of May 22, 1997 using EPA Reference Methods 18, 25A, and 202. Method 25A was used to determine total hydrocarbons (THC). Method 18 was used to analyze the stack gas with a gas chromatograph to detect the amounts of methane and ethane, which were subtracted from the measured THC values to yield the total amount of C_3^+ compounds, or VOCs in the stack gas sample. Method 202 was used to determine the amount of back-half organic compounds that condense out in the chilled impingers.

Three (3) test runs were evaluated by the Division to determine a representative ratio of back-half organics to total VOCs (back ½:VOC). The results of the testing indicated various back ½:VOC ratios ranging from 12.9% to 19.6%. The tests do not show a linear relationship of emissions as a function of production rate, based on the variability in the constituents of the raw trona ore; therefore, a worse-case source specific back ½:VOC ratio of 20% was assumed in this analysis. This ratio was multiplied by the total VOC emission rate from the proposed increases in the A&B Calciners, C Calciner and the proposed "D" Calciner to estimate maximum impacts from the condensible organics. It should be noted that the Division's methodology is only applicable to Calciners used in the processing of trona ore, having emission rates measured by the Reference Methods described above.

The background standard visual range (SVR) used in this analysis was based on the 90th percentile best-case visibility, as provided by the USFS; this data has been collected at the Jim Bridger Wilderness Area boundary since 1988 as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) monitoring program. The seasonal background SVR data reflect the impacts on visibility from existing emission sources. Therefore, the potential degradation of the existing visibility would be the result of the proposed new sources at Solvay, since the contribution of existing Solvay sources has already been included in the background SVR data. The background SVR used for the Class I area was 262 km, which is the current value based on the 90th percentile best-case visibility during the winter months.

The maginitude of emissions used in the visibility analysis were as follows:

Primary Particulate-	Sources 76, 79-83, 85	20.38 lb/hr
Condensable Organics	A&B Calciners	29.49 lb/hr
Condensable Organics	C Calciner	14.74 lb/hr
Condensable Organics	D Calciner	106.70 lb/hr

The maximum 24-hour concentrations of PM_{10} and condensible organics were 0.01026 and 0.0401 $\mu g/m^3$, respectively, based on the ISCST3 model. Source extinction coefficients were calculated by multiplying the maximum model predicted 24-hour PM_{10} concentration by a scattering efficiency of 0.003 m^2/kg, and the maximum model predicted 24-hour average condensible organic concentration by a scattering efficiency of 0.004 m^2/kg. Using a 90th percentile SVR of 262 km for the Bridger Wilderness Area, the maximum visibility impairment was calculated to be 0.127d deciviews.

The significance of Solvay Mineral's contribution to visibility impairment is based on a comparison with the acceptable visibility change criterion of 0.50 deciviews, as designated by the USFS. Based on the results of this analysis, it is expected that the regional haze impacts due to the proposed project will not significantly impair visibility in the Bridger Wilderness Area. The calculations and parameters used in the Division's analysis are provided in Appendix A.

Acid Deposition:

Emissions of NO_x and SO_2 have the potential to convert to nitrate and sulfate compounds, which can be deposited into sensitive lakes and other water bodies, and increase the acidity of these water bodies. Solvay Minerals is proposing to increase emission rates of PM_{10}, CO and VOCs above the significant emission rates that trigger PSD review for these pollutants. Since PM_{10}, CO and VOCs are not linked to increases in acid deposition, the applicant is not required to perform an acid deposition analysis under PSD regulations. However, as a courtesy to the USFS, an acid deposition analysis was completed based on the existing allowable NO_x emissions. The lakes considered in this analysis, along with their location and baseline acid neutralizing capacity (ANC) are provided in Table V.

A screening level assessment of acid deposition impacts was performed using a technique that combines the methodology recommended by IWAQM, and calculations found in a USFS draft report developed by D.G. Fox in 1983 entitled, <u>A Suggested Methodology for an Atmospheric Deposition Screening Technique</u>. This technique quantitatively estimates the change in pH and in alkalinity on a sensitive water body (i.e., mountain lake) associated with predicted ambient concentrations of SO_2 and NO_2. Nitrogen deposition rates are calculated based on a technique presented in IWAQM, by which deposition rates can be estimated from annual average modeled concentrations. The equations associated with this method are presented below:

$$\mathbf{D_N = k \times (C\ V_d)}$$

D_N = the dry deposition in g/m^2 - year of HNO_3
k = a constant to convert units and to account for the ration of molecular weights of HNO_3 to NO_2, multiplied by the number of seconds in a year and divided by 1×10^6 to convert from μg to g which equals 43.20
C = the maximum, annual, average concentration of NO_2 in $\mu g/m^3$
V_d = the deposition velocity, which is conservatively estimated as 0.05 m/sec

Table V. Inputs used in Acid Lake Deposition Analysis

Lake	UTM Coordinates (meters)		Elevation		ANC
	Easting	Northing	(feet)	(meters)	
Black Joe Lake	650,500	4,733,100	10,259	3,127	46
Deep Lake	648,600	4,731,400	10,502	3,201	40
Hobbs Lake	608,200	4,765,400	10,060	3,066	57
Ross Lake	609,000	4,805,300	9,675	2,949	51
Saddlebag Lake	644,400	4,720,800	11,262	3,433	28.4
Klondike Lake	611,000	4,787,500	11,215	3,418	20
Upper Titcomb Lake	640,500	4,717,500	10,597	3,230	34

The dry deposition rate is assumed to be approximately one-half of the total deposition rate, and thus, the value obtained from the equation is multiplied by two to provide an estimate of the total deposition rate. Once the total deposition rate of HNO_3 (D_N) is estimated, the change in pH (ΔpH) and percent change in alkalinity (ΔANC) from each of the sensitive lakes was calculated., based on background ANC information received from the USFS. The percent change in ANC was estimated by the following equation:

$$\mathbf{\Delta ANC = \{[(H_N/d)/1000]/A\} \times 100}$$

H_N	=	D_N / (10 x R_N x 63), in eq/m^2
D_N	=	HNO_3 deposition in kg/ha-yr
R_N	=	0.22 (ratio of N to HNO_3 molecular weights)
A	=	lake baseline ANC, in eq/l
d	=	annual precipitation, in meters

The total potential loss of ANC, in μeq/L, was compared to the baseline ANC for each lake. The resultant percent change was then compared to the significance criteria of 10% for lakes with baseline ANC's between 25-100 μeq/L, and 1 μeq/L change for water bodies with a baseline ANC less than 25 μeq/L.

The change in pH from the nitrate deposition into a sensitive lake is estimated by the following equation:

$$\mathbf{\Delta pH = \log(A) - \log\{A - [(H_N/d)/1000]\}}$$

A	=	lake baseline ANC, in eq/l
H_N	=	loss of ANC associated with the predicted ambient concentrations. D_N/(10 x R_N x 63), in eq/m^2
d	=	annual precipitation, in meters

The significance criterion for the change in pH is 10%. The change in pH for each lake was compared to this criterion to evaluate the significance of the change. The change in pH was calculated to be nearly imperceptible and was approximately two orders of magnitude below the significance criterion of 0.10. Therefore, the changes in ANC and pH from potential acid deposition impacts from Solvay Minerals are below the applicable significance criteria, and are expected to be minimal. The results of this analysis are presented in Table VI.

Table VI. Summary of Acid Deposition Results

Lake ID	Annual Modeled NOx Conc ($\mu g/m^3$)	Baseline ANC ($\mu eq/L$)	Δ ANC (%)	Δ pH (%)
Black Joe Lake	0.00118	46	0.655	0.0029
Deep Lake	0.00124	40	0.792	0.0035
Hobbs Lake	0.00086	57	0.386	0.0017
Ross Lake	0.00067	51	0.034	0.0015
Saddlebag Lake	0.00138	28	1.242	0.0054
Klondike Lake	0.00076	20	0.971	0.0042
Upper Titicomb Lake	0.00082	34	0.616	0.0027

Soils and Vegetation: The surrounding topography is characterized by uplifted fault blocks which form major ridges, and relatively flat-lying clay shale and siltstone deposits which form the intervening valleys. The ridges are mainly composed of limestones and quartz. Soils occurring at the ridge crests are typically shallow and have textures ranging from gravel to sandy loam. The soils have textural and drainage characteristics that limit the amount of water the soils can retain and make available for plant growth. additionally, there are no listed threatened or endangered species known to exist in this region. Therefore, the potential impacts on the surrounding soils and vegetation from the proposed expansion due to increased particulate deposition can be considered negligible.

Summary: The modeling analysis indicates that ambient concentrations of NO_x, PM_{10}, CO, and SO_2 are below the National Ambient Air Quality Standard (NAAQS), and correspondingly the NAAQS will be protected. The modeling analysis also indicates that all PSD Class I and Class II incremental impacts are below all applicable PSD standards. The Solvay facility adequately demonstrates compliance with Wyoming Ambient Air Quality Standards and is expected to have no significant impact on the existing ambient air quality.

PROPOSED PERMIT CONDITIONS:

1. Representatives of the Air Quality Division shall be permitted to enter and inspect any properties associated with this permit for the purpose of investigating actual or potential sources of air pollution, and for determining compliance with air quality regulations, standards, permits and orders.

2. All commitments and descriptions set forth in the application and subsequent revisions for this permit, unless superseded by a specific conditions of this permit, are incorporated herein by this reference and are enforceable as conditions of this permit.

3. For a major source, as defined by Section 30 (c)(i) of the WAQS&R, an application for an operating permit is required within 12 months of commencing operations.

4. Written notification of the anticipated date of initial startup, in accordance with Section 21(i) of the WAQS&R, is required 60 days prior to such date. Notification of the actual date of initial start-up is required 15 days after start-up.

5. Required performance tests will be conducted, in accordance with Section 21(j) of the WAQS&R, within 30 days of achieving maximum design rate but not later than 90 days after initial start-up, and a written report of the results be submitted. The operator shall provide 15 days prior notice of the test date. If maximum design production rate is not achieved within 90 days of start-up, the Administrator may require testing be done at the rate achieved and again when maximum rate is achieved.

6. The date of commencement of construction shall be reported to the Administrator within 30 days of commencement. The construction or modification must commence within 24 months of the date of permit issuance, in accordance with Section 21(h) of the WAQSR, or the permit becomes invalid. The Administrator may extend the period based on a satisfactory justification of the requested extension. If the construction is discontinued for a period of 24 months or more then the permit will also become invalid.

7. Solvay will operate the Green River plant trona calciner and dryers at production rates which do not exceed the rates listed in the following table.

Unit	Calciner Kilns: Trona Ore Feed Rate (TPH)	Calciner Kilns: Calcined Ore Production Rate (TPH)	Trona Ore Feed Rate Capacity @ Full Load (MMTPY)	Design Annual Trona Ore Feed Rate (MMTPY)
#17 "A" Calciner	200	147	1.752	1.577
#17 "B" Calciner	200	147	1.752	1.577
#48 "C" Calciner	200	147	1.752	1.577
#80 "D" Calciner	275	202	2.409	2.048
Totals	875	643	7.665	6.779

Unit	Dryer Kiln: Wet Crystal Feed Rate (TPH)	Dryer Kiln: Soda Ash Production Rate (TPH)	Soda Ash Production Capacity @ Full Load (MMTPY)	Design Annual Soda Ash Production (MMTPY)
#15 DR-1 Dryer	93	76	0.666	0.594
#15 DR-2 Dryer	93	76	0.666	0.594
#28 DR-4 Dryer	40	32	0.280	0.252
#51 DR-5 Dryer	150	122	1.069	0.962
#82 DR-6 Dryer	198	161	1.410	1.199
Totals	563	458	4.091	3.601

8. Maximum soda ash production at the Solvay soda ash plant will be limited to 3.60 million tons per year, from no more than 6.78 million tons per year of trona ore throughput.

9. The allowable particulate, sulfur dioxide and nitrogen oxide mass emission rates for Solvay Big Island Plant emission sources shall be limited to rates shown in Table I of this analysis.

10. Solvay will meet all applicable provisions of New Source Performance Standards Subpart OOO as they apply to the newly constructed equipment in the "D" process train. Thus baghouses AQD #'s 76, 79, 81 and 83 must maintain particulate emissions within 0.02 grains per dry standard cubic foot (gr/dscf) of baghouse exhaust and must hold visible emissions to within seven (7%) opacity.

11. Solvay will meet all applicable provisions of New Source Performance Standards Subpart Dc requirements as they apply to the newly constructed AQD #85 boiler. Under that section the owner/operator of a new boiler is required to submit notification of the dates of construction, anticipated and actual start-up, with confirmation of the design heat input capacity and fuels to be combusted.

12. The allowable opacity limits for AQD #80 calciner and AQD #82 dryer will be set based on correlation of the units' COM measured opacity during their initial performance testing and first 6 months of operating opacity data. Solvay shall submit a summary of opacity readings during the first 6 months of operation summarizing the monitored opacity readings in increments of 5 percent up to 20

percent. Based on the initial performance testing and first 6 months of operating opacity data, the Division will review and establish an allowable opacity limitation, not to exceed 20 percent. The allowable opacity limitation will be incorporated into the Section 30 operating permit for the expansion project. Until such time a reduced opacity limitation is established, the allowable opacity limit shall be set at 20 percent.

13. Solvay will install, calibrate, operate, maintain and report measured emissions from a continuous in-stack monitoring system on the source AQD #80 calciner stack for continuously measuring opacity emissions. The monitoring system shall be installed, calibrated and operated in compliance with the requirements set forth in Section 22(j) of the Wyoming Air Quality Standards & Regulations. Record keeping and excess emissions reporting shall comply with the requirements of Section 22(g) of the Wyoming Air Quality Standards & Regulations. Periods of excess emissions will be defined as any six minute average when the average opacity exceeds the figure defined by condition #12.

14. Solvay will install, calibrate, operate, maintain and report measured emissions from a continuous in-stack monitoring system on the source AQD #82 dryer stack for continuously measuring opacity emissions. The monitoring system shall be installed, calibrated and operated in compliance with the requirements set forth in Section 22(j) of the Wyoming Air Quality Standards & Regulations. Record keeping and excess emissions reporting shall comply with the requirements of Section 22(g) of the Wyoming Air Quality Standards & Regulations. Periods of excess emissions will be defined as any six minute average when the average opacity exceeds the figure defined by condition #12.

15. Solvay will submit the plans and specifications of the control equipment planned for installation under this permit to the Division for final approval, prior to installation.

    For electrostatic precipitators the information required includes the manufacturer and model number for the unit, the fan design exhaust rate (acfm & dscfm), the number of gas paths, the number of precipitator chambers on each path, the number of plates and wires per chamber, the total plate area per chamber, the number of transformer-rectifier energized sections per chamber, the design transport velocity inside each precipitator chamber, the design gas treatment time for the precipitator (seconds), the design electronics parameters (spark rates, and primary/secondary amperages and voltages), the design rapping duration and cycle time, and a three dimension view design drawing of the precipitator.

    For baghouses the information required includes the baghouse manufacturer and model number for the unit, the bag filter area, the fan design exhaust rate (acfm & dscfm), design air/cloth ratio, and a design drawing of the system showing duct layout, system hoods and pickup points, duct sizes and velocity/volume in each leg of the system.

16. As a permit condition, the Division will require that Solvay meet the design specifications and comply with the emission limits for equipment installed under the "D" train project, as considered in this permit analysis. Any alterations to these specifications will be reviewed for acceptability by the Division. If significant changes are made to control equipment or exhaust system parameters, revision to the existing permit emission limits may be made, or a new permit application may be required.

17. All compliance stack testing will be accomplished according to standard Reference Method testing, or other methodology specifically approved by the Administrator of the Air Quality Division. Regarding particulate emission tests, the Division will require utilization of Reference Method 5 sampling trains, with the back half impinger catch analyzed by the protocol defined by Reference Method 202. To determine compliance for any particular stack, the Division will compare the sum of the Reference Method 5 front half particulate catch and the inorganic (mineral) portion of the Reference Method 202 back half of these Method 5/202 tests, against the particulate emission standards set into this permit.

TABLE I
Solvay Trona Plant Pollutant Emission Rates (pph)
(Page 1/3)

Source Number	Equipment Description	Pollutants			
		PM_{10}	SO_2	NO_x	VOC
	Current Plant Emission Sources				
2a	Ore Crusher Building Baghouse #1	1.60	n.a.	n.a.	0.00
[illegible]	Ore Reclaim Baghouse #1	0.20	n.a.	n.a.	0.00
[illegible]a	Product Silo Top Baghouse #1	0.30	n.a.	n.a.	0.00
6b	Product Silo Reclaim Baghouse #1	1.40	n.a.	n.a.	0.00
7	Product Loadout Baghouse #1	1.20	n.a.	n.a.	0.00
10	Coal Crushing & Storage Baghouse	0.60	n.a.	n.a.	0.00
11	Coal Transfer Station Baghouse	0.60	n.a.	n.a.	0.00
14	Boiler Coal Bunker Baghouse	1.00	n.a.	n.a.	0.00
15	DR-1 & 2 Product Dryers Scrubber	6.80	n.a.	1.20	0.06
16	Dryer Area Housekeeping Baghouse	0.90	n.a.	n.a.	0.00
17	"A" & "B" Gas Fired Ore Calciners	22.30	0.00	20.00	628.56
18	#1 Coal Boiler Scrubber & Prcptr	17.00	70.00	245.00	0.50
19	#2 Coal Boiler Scrubber & Prcptr	17.00	70.00	245.00	0.50
20	Gas & Diesel Storage Tanks	n.a.	n.a.	n.a.	0.02
24	Boiler Flyash Silo Vent Baghouse	0.30	n.a.	n.a.	0.00
25	Alkaten Crushing Area Baghouse	1.00	n.a.	n.a.	0.00
26	DR-3 Alkaten Product Dryer Baghouse	1.10	n.a.	n.a.	0.00
27	Alkaten Product Bagging Baghouse	0.50	n.a.	n.a.	0.00
28	DR-4 Fld Bed Product Dryer Scrubber	2.90	n.a.	n.a.	0.00
30	Caustic #1 Lime Bin Baghouse	0.20	n.a.	n.a.	0.00
31	Caustic #2 Lime Bin Baghouse	0.20	n.a.	n.a.	0.00
[illegible]	Caustic Evaporator Brmtrc Condenser	0.00	n.a.	n.a.	0.00
[illegible]	Sulfite Sulfur Burner Scrubber	n.a.	0.40	1.50	0.00
34	Sulfite Crystallizer	0.00	n.a.	n.a.	0.00
35	Sulfite Product Dryer Scrubber	1.40	n.a.	n.a.	0.00
36	Sulfite #1 Product Bin Baghouse	0.10	n.a.	n.a.	0.00
37	Sulfite #2 Product Bin Baghouse	0.10	n.a.	n.a.	0.00
38	Sulfite #3 Product Bin Baghouse	0.10	n.a.	n.a.	0.00
39	Sulfite #4 Product Bin Baghouse	0.10	n.a.	n.a.	0.00
40	Sulfite Product Bagging Baghouse	0.30	n.a.	n.a.	0.00
41	Sulfite Product Loadout Baghouse	0.40	n.a.	n.a.	0.00
42	Sulfite HCl Tank Vent	n.a.	n.a.	n.a.	0.00
43	Sulfite Sulfur Tank Storage Vent	n.a.	n.a.	n.a.	0.00
44	Caustic Lime Delivery Baghouse	0.90	n.a.	n.a.	0.00
45	Alkaten Transloading Baghouse	0.20	n.a.	n.a.	0.00
46	#2 Ore Transfer Baghouse	1.20	n.a.	n.a.	0.00
47	"C" Train Ore Crusher Baghouse	5.10	n.a.	n.a.	0.00
48	"C" Ore Calciner Precipitator	9.30	n.a.	10.00	314.28
50	"C" Train Dryer Area Baghouse	2.10	n.a.	n.a.	0.00
51	DR-5 Product Dryer Precipitator	4.80	n.a.	18.00	0.28
52	Product Silo Top Baghouse #2	0.50	n.a.	n.a.	0.00
53	Product Silo Reclaim Baghouse #2	1.10	n.a.	n.a.	0.00
[illegible]	T-200 Product Storage Baghouse	0.19	n.a.	n.a.	0.00
[illegible]	Recycle/Reclaim Baghouse	0.40	n.a.	n.a.	0.00
62	Activated Carbon Bin Vent	0.13	n.a.	n.a.	0.00
63	Perlite Bin Vent Baghouse	0.17	n.a.	n.a.	0.00
64	Sulfite Blending #2 Baghouse	0.15	n.a.	n.a.	0.00

TABLE I

Solvay Trona Plant Pollutant Emission Rates (pph)

(Page 2/3)

Source Number	Equipment Description		Pollutants PM_{10}	SO_2	NO_x	VOC
65	Sulfite Blending #1 Baghouse		0.06	n.a.	n.a.	0.00
66	Carbon/Perlite Additive Scrubber		0.55	n.a.	n.a.	0.00
[illegible]	Bottom Ash Baghouse		0.47	n.a.	n.a.	0.00
[illegible]	Trona Silo/Bagging Machine Baghouse		0.41	n.a.	n.a.	0.00
69	Soda Ash Silo/Bagging Machine Baghouse		0.41	n.a.	n.a.	0.00
70	Sulfite Silo/Bagging Machine Baghouse		0.41	n.a.	n.a.	0.00
71	MBS Silo/Bagging Machine Baghouse		0.41	n.a.	n.a.	0.00
72	MBS Soda Ash Feed Bin Vent Filter		0.14	n.a.	n.a.	0.00
73	MBS Product Dryer		1.20	0.77	0.15	0.00
MV	Mine Vent		n.a.	n.a.	n.a.	115.00
	Subtotal, Current Plant Emissions (pph)		109.93	141.17	540.85	1059.20
	Annual Emission Totals (TPY)		481.5	618.3	2368.9	4639.3
	Current Proposed Plant Modifications					
2a	Ore Crusher Building Baghouse #1	(RMV)	-1.60	n.a.	n.a.	0.00
2a	Ore Crusher Building Baghouse #1	(ADD)	1.60 β	n.a.	n.a.	0.00
2b	Ore Reclaim Baghouse #1	(RMV)	-0.20	n.a.	n.a.	0.00
6b	Product Silo Reclaim Baghouse #1	(RMV)	-1.40	n.a.	n.a.	0.00
6b	Product Silo Reclaim Baghouse #1	(ADD)	0.51	n.a.	n.a.	0.00
10	Coal Crushing & Storage Baghouse	(RMV)	-0.60	n.a.	n.a.	0.00
10	Coal Crushing & Storage Baghouse	(ADD)	0.26 α	n.a.	n.a.	0.00
11	Coal Transfer Station Baghouse	(RMV)	-0.60	n.a.	n.a.	0.00
11	Coal Transfer Station Baghouse	(ADD)	0.21 α	n.a.	n.a.	0.00
[illegible]	Boiler Coal Bunker Baghouse	(RMV)	-1.00	n.a.	n.a.	0.00
14	Boiler Coal Bunker Baghouse	(ADD)	0.37 α	n.a.	n.a.	0.00
15	DR-1 & 2 Product Dryers Scrubber	(RMV)	-6.80	n.a.	-1.20	-0.06
15	DR-1 & 2 Product Dryers Scrubber	(ADD)	4.34	n.a.	1.20	0.06
17	"A" & "B" Gas Fired Ore Calciners	(RMV)	-22.30	0.00	-20.00	-628.56
17	"A" & "B" Gas Fired Ore Calciners	(ADD)	22.30	0.00	30.00	776.00
18	#1 Coal Boiler Scrubber & Prcptr	(RMV)	-17.00	-70.00	-245.00	-0.50
18	#1 Coal Boiler Scrubber & Prcptr	(ADD)	5.00	70.00	245.00	0.50
19	#2 Coal Boiler Scrubber & Prcptr	(RMV)	-17.00	-70.00	-245.00	-0.50
19	#2 Coal Boiler Scrubber & Prcptr	(ADD)	5.00	70.00	245.00	0.50
26	DR-3 Alkaten Product Dryer Baghouse	(RMV)	-1.10	n.a.	n.a.	0.00
26	DR-3 Alkaten Product Dryer Baghouse	(ADD)	0.55	n.a.	0.25	0.01
41	Sulfite Product Loadout Baghouse	(RMV)	-0.40	n.a.	n.a.	0.00
41	Sulfite Product Loadout Baghouse	(ADD)	0.19	n.a.	n.a.	0.00
44	Caustic Lime Delivery Baghouse	(RMV)	-0.90	n.a.	n.a.	0.00
44	Caustic Lime Delivery Baghouse	(ADD)	0.18 α	n.a.	n.a.	0.00
46	#2 Ore Transfer Baghouse	(RMV)	-1.20	n.a.	n.a.	0.00
46	#2 Ore Transfer Baghouse	(ADD)	0.71	n.a.	n.a.	0.00
47	"C" Train Ore Crusher Baghouse	(RMV)	-5.10	n.a.	n.a.	0.00
48	"C" Ore Calciner Precipitator	(RMV)	-9.30	n.a.	-10.00	-314.28
[illegible]	"C" Ore Calciner Precipitator	(ADD)	9.30	n.a.	15.00	388.00
[illegible]	"C" Train Dryer Area Baghouse	(RMV)	-2.10	n.a.	n.a.	0.00
50	"C" Train Dryer Area Baghouse	(ADD)	0.70	n.a.	n.a.	0.00
51	DR-5 Product Dryer Precipitator	(RMV)	-4.80	n.a.	-18.00	[illegible]
51	DR-5 Product Dryer Precipitator	(ADD)	2.40	n.a.	18.00	0.28

Source Number	
53	[illegible]
	Subtotal, Current P[illegible]
	Subtotal, Bagging Facili[illegible]
	Subtotal,[illegible]
	Grand Tota[illegible]

****** Footnotes ******

α ➔ Sources will operate on a schedule of 12 hours/day, therefore annual emissions are based on one half of a year, or 4380 hours operation.

β ➔ Source #2a industrial ventillation system will be modified to include dust collection from pick up points from the existing source #47 cusher baghouse, while #47 is eliminated from the plant inventory. The #2a fan will not be changed, however, and that fan's exhaust air volume will simply be re-apportioned throughout the modified collection ductwork. With the same projected exhaust volume, the existing source #2a particulate emission rate will remain at 1.60 pph.

Table II
Solvay Minerals
VOC / HAP's INVENTORY (lb/hr by source)
Page 1 of 2

Process Source Identification Numbers

		Calciners			Soda Ash/Alkalen Dryers					Sulfite Dryers		Mine Vent & Miscellaneous Sources						Boilers			Housekeeping Baghouse Indentification Numbers												
		AQD #17 Calciner	AQD #48 Calciner	AQD #80 Calciner	AQD #15 SA Dryer	AQD #26 Tr Dryer	AQD #28 FB Dryer	AQD #51 SA Dryer	AQD #82 SA Dryer	AQD #35 S/ Dryer	AQD #73 Ms Dryer	Mine Vent	AQD #20 Gas Tank	AQD #32 Cs Evap	AQD #33 Sulfr Bmr	AQD #42 HCl Tank	AQD #43 Slfr Tank	AQD #18 Boiler	AQD #19 Boiler	AQD #85 Boiler	AQD #2a Dst Clctr	AQD #6a Dst Clctr	AQD #6b Dst Clctr	AQD #7 Dst Clctr	AQD #10 Dst Clctr	AQD #11 Dst Clctr	AQD #14 Dst Clctr	AQD #16 Dst Clctr	AQD #24 Dst Clctr	AQD #25 Dst Clctr	AQD #27 Dst Clctr	AQD #30 Dst Clctr	AQD #3 Dst Clctr
Total Volatile Organic Compounds * ==>		776.00	388.00	533.50	0.08	0.01	Insignif	0.28	0.27	Insignif	Insignif	115.00	0.02	Insignif	Insignif	Insignif	Insignif	0.50	0.50	0.27	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
HAP's (Method 0030)	CAS Number																																
Benzene	000071-43-2	25.0600	10.6100	17.2300	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.2900	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
1,3 Butadiene	000106-99-0	51.8800	30.9400	35.6800	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
Ethylbenzene	000100-41-4	6.1500	1.7300	4.2300	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
2-Butanone	000078-93-3	19.6200	2.6600	13.4800	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.7700	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
Hexane	000110-54-3	14.7100	6.9000	10.1100	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	[illegible]	0.4300	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
S e	000100-42-5	5.9600	4.1800	4.1000	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0600	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	[illegible]
Toluene	000108-88-3	13.2900	3.4000	9.1400	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	2.5100	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
X	001330-20-7	22.6000	7.7800	15.5400	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	8.6700	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
** 1 1 1 T e	00071-55-6	11.4300	4.0300	7.6600	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
** Acrilonitrile	000107-13-1	5.4500	1.5200	3.7500	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
** M ene Chloride	000075-09-2	1.2600	1.8900	0.6700	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif
** Trichloroe	000079-01-6	38.2800	3.7800	26.3200	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
Subtotal VOC HAP's ==>		215.[illegible]	[illegible]	148.3200	0.0000	0.0000	[illegible]	0[illegible]	0.0000	0.[illegible]	0.[illegible]	2.[illegible]	0.[illegible]	0.[illegible]	0.0000	[illegible]	[illegible]	[illegible]	0.0000	[illegible]	0.0000	0.0000	0.0000	0.0000	0.0000	0[illegible]	0.0000	0.0000	0.0000	0.[illegible]	0[illegible]	0.[illegible]	[illegible]
HAP's Method 0010	CAS Number																																
Aceto one	000098-86-2	0.0160	0.0080	0.1100	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
en	000092-52-4	0.0228	0.0114	0.0157	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
[illegible]	000117-81-7	0.0015	0.0008	0.0011	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
[illegible]	000532-27-4	0.0014	0.0007	0.0010	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
m- o-	000108-39-4	0.0093	0.0047	0.0064	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
Cumene	000098-82-8	0.0018	0.0009	0.0012	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	[illegible]	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif
Dibenzofuran	000132-64-9	0.0181	0.0065	0.0131	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
[illegible]	000084-74-2	0.0115	0.0058	0.0079	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	[illegible]	Insignif	Insignif	Insignif	[illegible]
N ine	000121 7	0.0076	0.0038	0.0052	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif
N	000091-20-3	0.1477	0.0739	0.1016	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
Phenol	000108-95-2	0.0907	0.0453	0.0623	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]
Subtotal SV HAP's ==>		0.3294	0.1648	[illegible]	[illegible]	0.0000	[illegible]	[illegible]	0.0000	0.0000	[illegible]	0.0000	0.[illegible]	0.0000	0.0000	0000	0.[illegible]	0.[illegible]	[illegible]	0.0000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0000	0.[illegible]	[illegible]	0.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HAP's (Method 0011	CAS Number																																
Formaldeh	000050-00-0	0.3800	0.1200	0.2600	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
Acetaldeh	000075-07-0	1.1900	0.2400	0.6200	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif
[illegible]	000123-38-6	0.4200	0.0700	0.2900	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif
Acrolein	000107-02-8	1.7400	0.3100	1.2000	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	[illegible]	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif
Subtotal Alde & Ketone s ==>		3.[illegible]	0.7400	2.[illegible]700	[illegible]	[illegible]	0.[illegible]	.[illegible]	[illegible]	[illegible]	0.0000	[illegible]	0.0000	[illegible]	[illegible]	0.0000	0.0000	0.0000	[illegible]	0.[illegible]	0.	[illegible]	0[illegible]	0[illegible]	0.[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
T s ==>		21[illegible]	80.3348	151.21[illegible]	0[illegible]	0.0000	0.0000	0.0000	0.	0.0000		12.[illegible]	0.0000	0.[illegible]	0	[illegible]		0.0000	0.0000	0.	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* [illegible]n methane/non ethane hydrocarbons - Methods 18 & 25A
** These four compounds may have been misidentified during the GC stack tests. The more accurate GC/MS did not identify these compounds.
[illegible] = emission rate considered insignificant per testing or process knowledge

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Table II
SOLVAY MINERALS
VOC / HAP's INVENTORY (lb/hr by source)
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ousekeeping Baghouse Indentification Numbers

AQD #36 Dst Clctr	AQD #37 Dst Clctr	AQD #38 Dst Clctr	AQD #39 Dst Clctr	AQD #40 Dst Clctr	AQD #41 Dst Clctr	AQD #44 Dst Clctr	AQD #45 Dst Clctr	AQD #46 Dst Clctr	AQD #50 Dst Clctr	AQD #52 Dst Clctr	AQD #53 Dst Clctr	AQD #54 Dst Clctr	AQD #55 Dst Clctr	AQD #62 Dst Clctr	AQD #63 Dst Clctr	AQD #64 Dst Clctr	AQD #65 Dst Clctr	AQD #66 Dst Clctr	AQD #67 Dst Clctr	AQD #68 Dst Clctr	AQD #70 Dst Clctr	AQD #71 Dst Clctr	AQD #72 Dst Clctr	AQD #74 Dst Clctr	AQD #75 Dst Clctr	AQD #76 Dst Clctr	AQD #77 Dst Clctr	AQD #78 Dst Clctr	AQD #79 Dst Clctr	AQD #81 Dst Clctr	AQD #83 Dst Clctr	AQD #84 Dst Clctr	Plant Total	
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	1814.41	<== Total VOC's *
																																		HAP's (Method 0030)
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	53.1900	Benzene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	116.5100	1,3 Butadiene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	12.1100	Ethylbenzene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	36.5400	2-Butanone
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	32.1500	Hexane
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	14.3200	Styrene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	28.3400	Toluene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	54.5000	Xylene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	23.3200	** 1,1,1 Trichloroethane
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	10.7200	** Acrilonitrile
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	4.0200	** Methylene Chloride
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	68.3900	** Trichloroethylene
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	456.2000	<== Subtotal VOC HAP's
																																		HAP's (Method 0010)
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.1340	Acetophenone
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0499	Biphenyl
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0034	bis(2-Ethylhexyl)phthalate
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0031	2-Chloroacetophenone
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0304	m-, o-, p- Cresols
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0039	Cumene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0417	Dibenzofuran
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0253	Di-n-butylphthalate
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.0106	N,N-dimethylaniline
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.3232	Naphthalene
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.1983	Phenol
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8197	<== Subtotal SVOC HAP's
																																		HAP's (Method 0011)
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.7000	Formaldehyde
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	2.2800	Acetaldehyde
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	0.7800	Propionaldehyde
Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	Insignif	3.2800	Acrolein
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	7.0400	<== Subtotal A & K HAP's
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	464.0597	<== Total Title III HAP's

* Non methane/non ethane hydrocarbons - Methods 18 & 25A

** These four compounds may have been misidentified during the GC stack tests. The more accurate GC/MS did not identify these compounds.

Insignif = emission rate considered insignificant per testing or process knowledge

SOLVAY2016_1.4_001264